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ABSTRACT

Sixty-two first graders identified as being at risk for later learning difficulties were assigned to either of two special classes or distributed through regular first grade classes and were provided with one of the following forms of treatment: direct teaching of reading, indirect teaching (perceptual-motor training), combined treatment, and control (Ss placed in conventional classes). Phase I of the program involved group instruction within treatment approaches, while phase II involved individualized instruction within the same treatment approaches. Major findings of the study were that low but statistically significant correlations between treatment method and posttest achievement existed (the indirect and combined groups showed better achievement than the direct and control groups); and that number tests and teacher ratings had the greatest predictive power. Results may have been affected by age limitation of Ss, limited amount of time spent on experimental methods (1/2 hour per day) and treatment by a perceptual-motor specialist of Ss in the indirect method during phase I. Approximately half the document consists of appendixes on the following topics: a proposal for an experimental model school program for children with specific learning disabilities, a review of the literature, the Wellesley Rating Scale, the letter names pretest, the early detection inventory - geometric figures, the screening inventory of the project, interim posttesting results, a description of the Waltham motor tasks test, recommended strategies for perceptual and cognitive remediation, a parent questionnaire, and audiovisual supplementation. (DB)

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FINAL REPORT

ESEA
Title VI-A
Public Law 89-10
Project No. 70-308-018

EXPERIMENTAL MODEL SCHOOL PROGRAM FOR CHILDREN WITH SPECIFIC LEARNING DISABILITIES - 1970

Blanche L. Serwer, Ph.D.

Project Director

Elementary Secondary Education Act
(ESEA)
Commonwealth of Massachusetts
Department of Education
Division of Curriculum and Instruction
Bureau of Special Education
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182 Tremont Street
Boston, Massachusetts

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Blanche L. Serwer, Ph.D., Project Director
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March, 1971

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The research reported herein was performed pursuant to a contract with the Commonwealth of Massachusetts Department of Education through the Elementary Secondary Education Act, ESEA

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APPENDIX

Participants in the Waltham S.L.D. Project

WALTHAM PERSONNEL

	Plympton School	Whittemore School
First grade teacher:	Muriel Bloch	Helen Mace
Principal:	Helen T. Flynn	Joseph A. Cardello
Kindergarten teachers:	Josephine Gibbs	Barbara Kauffman
	Jeanne Elliot	Maude Tayne
	Mary L. Keegan	Mary L. Howe
Special Personnel:	Judith T. Harrison, psychologist	
	Carol A. Wadell, motor specialist	
	Tina Federico, Ed.D., director, Learning Disabilities	
	Doris H. Barton,	reading specialist
	Rita H. Lyons,	reading specialist
	Irja E. Hykkyri,	reading specialist
	Gerardo Tempesta,	reading specialist
	Shirley Gott,	reading specialist
	Elyse Levy,	reading specialist
	Richard Walsh,	computer analyst
	Eleanor B. Linehan, Ed.D., Assistant Superintendent of Schools in charge of Elementary Schools	

BOSTON UNIVERSITY

Graduate Student Research Team:	Dorothy A. Weber
	Jean S. North
	Roberta Best
	James McCloughlin
Statistical Consultants:	Bernard Shapiro, Ed.D.
	Phyllis Shapiro, Ed.D.,
Project Director:	Blanche L. Serwer, Ph.D.

HARVARD UNIVERSITY School of Education

Graduate Student Research Team:	Joanne Kennedy
	Martha Arey

ACKNOWLEDGEMENTS

The "Experimental Model School Program for Children with Specific Learning Disabilities - 1970" was an ambitious effort to study the relative effectiveness of different strategies in the treatment of children who show early signs of difficulty in learning. It was a one-year study starting in May, 1969 and ending in June, 1970.

The project was made possible by a contract from the Bureau of Special Education of the Commonwealth of Massachusetts Division of Education through ESEA, the Elementary Secondary Education Act. In addition to this financial support, the project received many kinds of assistance from the Waltham School District through the administrative efforts of Dr. Eleanor B. Linehan, Assistant Superintendent in charge of Elementary Education. It also benefited from the deliberation of the Massachusetts Psychological Center Task Force especially formed to plan for it. Gratitude is extended to Dr. Michael Rossi, chairman of the Massachusetts Psychological Center for his consistent support.

The project was vitalized by the excellent teaching and the cooperative effort of the two teachers, Muriel Bloch of the Plympton School and Helen Mace of the Whittemore School, who taught the experimental first grade classes. Thanks is expressed to the two principals, Helen T. Flynn and Joseph A. Cardillo of Plympton and Whittemore respectively, and to the three kindergarten teachers in each school: Barbara Kauffman, Maude Tayne and Mary L. Howe of Whittemore and Josephine Gibbs, Jeanne Elliot and Mary L. Keegan of Plympton.

Many people were particularly helpful during the experimental year, in carrying on the myriad details generated by a full testing program. Special thanks go to several members of the Special Services staff of the Waltham School Department, who gave their full cooperation: Judith T. Harrison, Psychologist; Carol L. Wadell, Motor Specialist; six Reading Specialists; Doris H. Barton, Rita H. Lyons, Irja E. Hykkyri, Gerardo Tempesta, Shirley Gott, and Elyse Levy; and Dr. Tina Federico, Director of Learning Disabilities.

Four graduate students of the Boston University School of Education were a devoted source of help in administering tests and recording data. Special thanks go to Dorothy Weber, Jean North, Roberta Best and James McCloughlin.

This consistent assistance was instrumental in bringing the project to a successful conclusion.

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PREFACE

This study was initiated by the joint efforts of the Waltham School District and the Massachusetts Psychological Center.

A Task Force of the M.P.C. had, during the year 1968-69, met regularly to discuss Waltham's request for assistance in determining the most effective way of educating children with Specific Learning Disabilities. The proposal prepared by the M.P.C. Task Force, entitled "A Proposal for an Experimental Model School Program for Children with Specific Learning Disabilities," is Appendix I of this report.

Major differences between the M.P.C. proposal and the Waltham Project as executed are given below, with reasons for the changes:

M.P.C. RECOMMENDATION	WALTHAM PROJECT AS EXECUTED	REASON FOR CHANGE
Screened population: all Waltham first-graders going into second grade.	Approximately 300 kindergarteners going into first grade in two selected schools.	Waltham had an on-going second grade project.
Experimental Sample: 32 second graders in 4 special classes of 8 pupils each.	62 first graders, 42 in 2 experimental regular first grades of 21 each, and 20 controls distributed throughout the unexperimental first grade classes in the 2 schools	Cost of 4 special teachers prohibitive
Experimental Sample to be diagnosed and tested: 32	63	
Treatment of SLD children from system-wide schools in special classrooms to be established in one school. A transportation problem would have resulted.	Treatment of SLD children selected from two schools was done in their own classrooms, each in its own school.	Transportation problem was avoided. More natural situation applicable system-wide without extra cost.
Research Design: Matched Groups.	Analysis of variance, F ratio.	Loss of population through matching was avoided.
Each of 4 teachers would teach an experimental class one of two methods: thus 2 whole classes in each experimental group.	2 teachers each taught one class divided into 3 experimental groups (7,7,7 = 21). See Flow Chart and Introduction below.	Teacher differences, a major source of variance was avoided. The design included its own replication, each school an experimental unit.
The 4 teachers were to have had a course in S.L.D. before on-set of the project.	The 2 teachers were guided in S.L.D. techniques by the Project Director.	The regular Waltham teachers used had had many years of excellent rich experience, but no special training in S.L.D.

M.P.C. RECOMMENDATION	WALTHAM PROJECT AS EXECUTED	REASON FOR CHANGE
Supportive services listed on page 6 of M.P.C. Proposal were to be provided by M.P.C.	Supportive services were given by the Project Director's graduate students and colleagues; as well as Waltham personnel	
Medical examinations were to be given to each child.	Medical examinations, although requested, were not given	It proved unfeasible for the Medical Department to administer 63 medical examinations

Note re Delay in Processing of Data: The reason for the three-month delay in the completion of this report should be stated because it is relevant not only to this research but to many multivariate analyses which produced large correlation matrices and analyses of variance.

These data were scheduled to be processed at the Waltham Data-Processing Center which is used for institutional and financial city purposes. Although much time and effort were expended by Mr. Richard Walsh, of the Waltham Computer Unit, it became apparent that the computer was not appropriate for the processing of this number of variables. Much gratitude is expressed to Mr. Walsh who tried valiantly to help us but who encountered insurmountable frustration in this effort.

The data were finally processed in February and March in the Boston University Computer Center. Gratitude is expressed to Dr. Bernard Shapiro, Associate Professor at Boston University who undertook the data processing.

Additional processing (see the section of this report entitled Recommendations for the Future) will be done at Boston University.

Preface Continued

In order to clarify the sequence of the Waltham Project, two summaries are included in this preface:

1. Time-Table of the Waltham Project, describing the progress of the project by date from the Winter of 1968-69 when it was conceptualized.
2. Two flow-charts which were drawn in advance as guides to future phases of the project.

   Flow-chart 1a, devised in May, 1969, shows the sweep of the research as originally projected.

   Flow-chart 1b, revised in October, 1970, after the experimental phase had been completed and the data collected and organized. It was at this juncture that the project was undergoing enforced delay due to vicissitudes in computer processing. As a result, the data cards were repunched at Boston University and the data processed at the Boston University Computer Center. Flow-chart 1b includes some of the revisions in research design during the months preceding and projected ahead to the completion of the research.

Time Table of the Waltham Project

Winter 1968-1969: Massachusetts Psychological Center Task Force met periodically

April 1969: Director was appointed

May 6, 1969: Director met with administrative personnel of the Waltham School Department

May 21, 1969: School personnel of Waltham met with Director: Assistant Superintendent in charge of elementary schools, all kindergarten teachers, two first grade teachers selected to teach the experimental classes, two principals, perceptual-motor specialist, reading consultants, director of secondary reading, two Harvard Interns. The project was explained in detail.

Accomplished: two phases of the screening:

1. Kindergarten teachers' spontaneous list of high-risk children
2. Wellesley 10-item Teacher Questionnaire

May-June, 1969: Third phase of screening: group measures, administered to entire population of approximately 300 children.

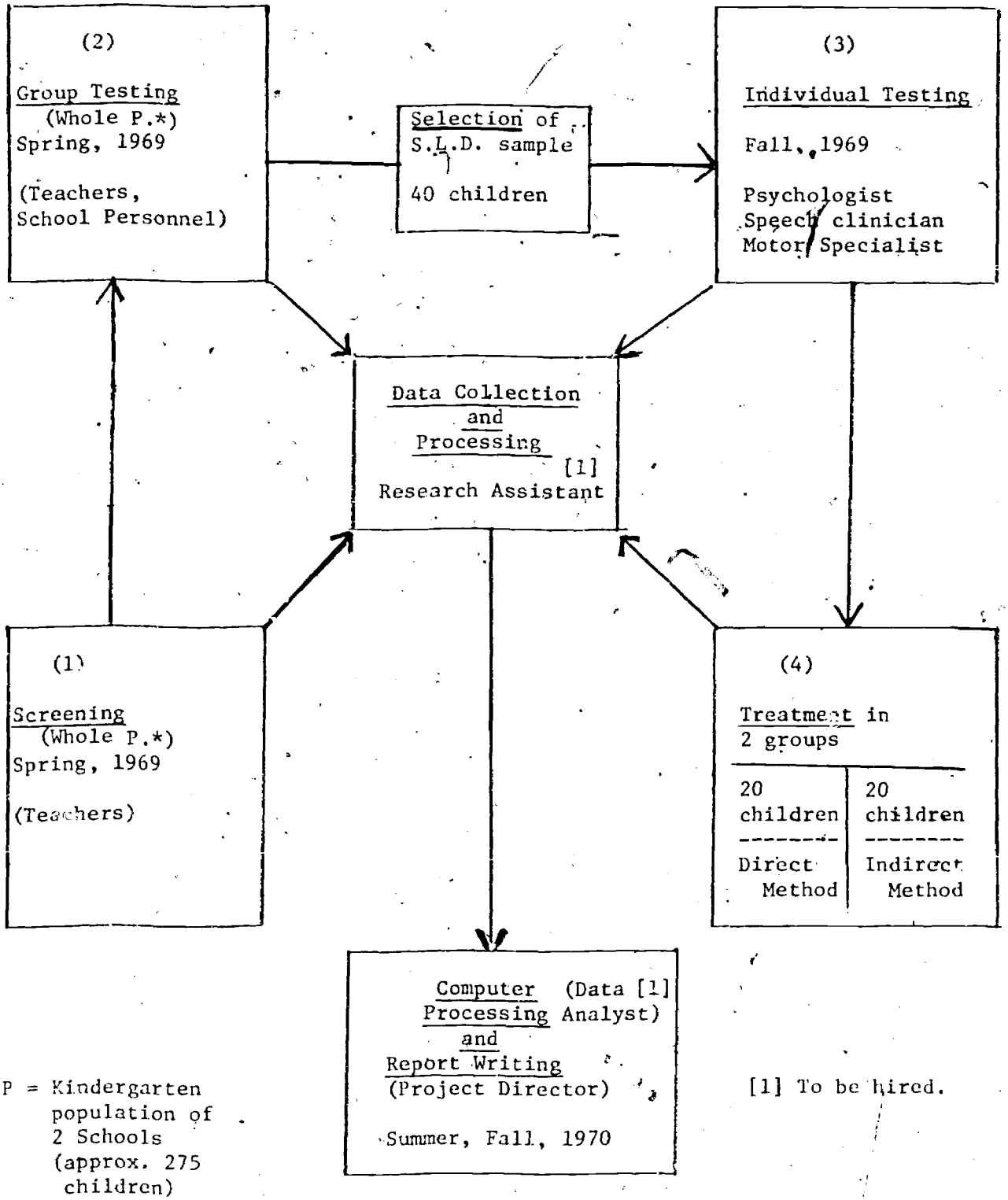
1. Goodenough-Harris Drawing Test
2. Early Detection Inventory: Geometric figures
3. Durrell Letter Names Test (individually administered)
4. Metropolitan Readiness Test

September 4, 5, 1969: Third phase of screening completed (group measures)

5. Primary Mental Abilities Test
6. Frostig Developmental Test of Visual Perception

September 15-22, 1969: Experimental classes organized, Teacher Training meetings. Basic program for two classes established, experimental treatment to be limited to 30 minutes a day, 2½ hours a week

September 22 - February 12: 1969	1. First phase of experimental treatment in groups 2. Diagnostic testing period - individual diagnostic tests administered to 62 children in the experimental sample
December 17-22, 1969:	Interim Post-Testing. Group instruction continued
February 13-20, 1970:	Spring vacation. Boston University Research group set up prescriptive program for children according to results of diagnostic tests
February 22 - May 22, 1970:	Second Phase of Instructional Period. Prescriptive teaching within the experimental groups (Direct, Indirect, and Combined) now individualized
May 22-29, 1970:	Final Post-Testing
June 1-10, 1970:	Scoring and Tabulating by Waltham special school personnel
June - July 31, 1970:	Processing on Waltham Computer attempted
September, 1970 March, 1971:	Transfer to Boston University Computer Center; data cards repunched. Data processed
March - April, 1971:	Write-up

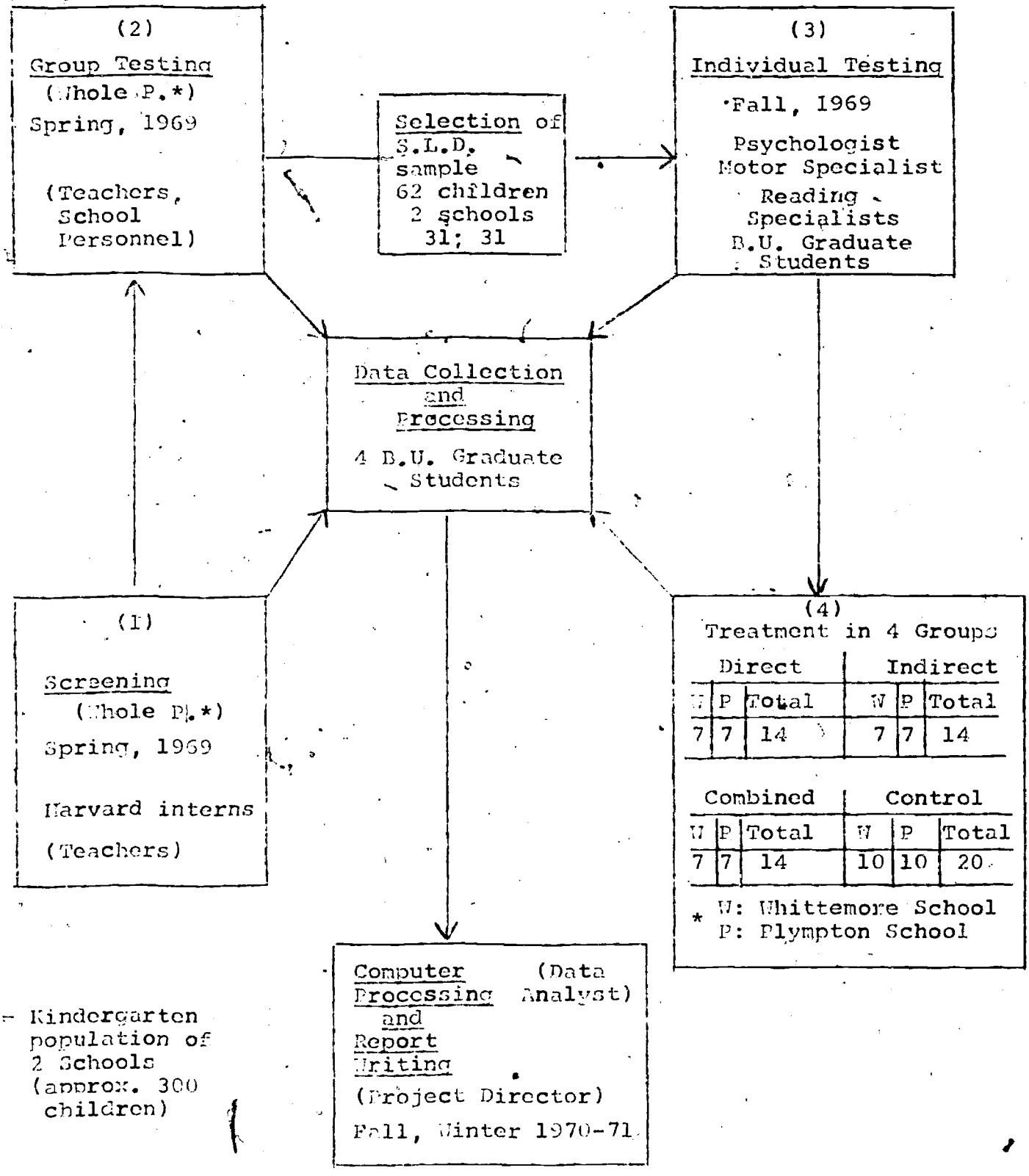


*P = Kindergarten population of 2 Schools (approx. 275 children)

[1] To be hired.

Figure 1a Flow Chart of Screening, Testing, Treatment, Data Processing and Report Writing May, 1969

Waltham Specific Learning Disability Project



*P = Kindergarten population of 2 Schools (approx. 300 children)

Figure 1b. Flow Chart of Screening, Testing, Treatment, Data Processing and Report Writing

Experimental Model School Program for Children with Specific Learning Disabilities - 1970

Introduction

Perceptual training as an adjunct to the teaching of reading has generated considerable controversy. A number of practitioners in the field, e.g., (Kephart, 1963-64; Johnson and Myklebust, 1967, Frostig and Horne, 1964; Ayers, 1966) assert that treatment of modality deficiencies, e.g. (auditory discrimination, visual discrimination, inadequacy in fine and gross motor skills - etc.) is related to success in reading. On the other hand, a considerable number of educators, e.g., (Durrell, 1969; Harris, 1970; Bush & Huebner, 1970) stress direct remedial reading techniques.

Recent state laws require local school systems to formulate educational programs to identify and treat children with learning disorders.* However, this task is made difficult by the ambiguity of research reports and theoretical stances.** The research evidence at this juncture tends to confuse rather than clarify. Many measuring instruments are used for prediction without sufficient empirical evidence that they have adequate predictive power.

The purpose of this study was to (a) study the relative

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* Although the term learning disorders includes cognitive, affective and social dimensions, the present study focused on the cognitive areas of language arts and arithmetic.

** Reviews of the literature are included in Appendix II divided into 3 categories: Perceptual Motor Training, Auditory Perception and Intersensory Processing.

effectiveness of remediation techniques and (b) identify the most effective sub-tests of total test batteries for purposes of prediction. Specifically two questions were asked:

(1) Which techniques are most effective for identified 'high-risk' first graders?

(2) Which sub-tests of the total available measuring instruments are the best predictors of achievement in language arts and arithmetic?

The Subject Sample

For this study two schools were selected in the Waltham school system. The children were from a wide range of socio-economic backgrounds. Approximately 300 children in 6 kindergarten classes (3 in each school) constituted the total population. From the 300 youngsters screened, on the basis of evaluation (as described under procedures) 62 'high-risk' pupils (37 boys, 25 girls) were selected as the experimental sample. The following chart indicates the numbers of children in each group at the two schools.

Direct			Indirect			Combined			Control			Total		
W	P	Total	W	P	Total	W	P	Total	W	P	Total	W	P	Total - Sample
7	7	14	7	7	14	7	7	14	10	10	20	31	31	62

W: Whittemore School
P: Plympton School

Procedures

Screening

In planning the screening procedures, the research team wished to use techniques that could be replicated on larger populations since identifying "high-risk" or learning disability children is a problem faced by all communities. The research team therefore planned a three-phase screening with the eventual goal of evaluating the relative effectiveness of the three methods employed: (1) free teacher observations, (2) a structured teacher-questionnaire, The Wellesley Rating Scale* and (3) formal testing measures.

This series of screening procedures ranged from simple to complex. In method I the kindergarten teachers responded spontaneously to the question, "In your opinion which children in your class will have difficulty learning to read and write in Grade 1?" Method 2 consisted of a 10-item formal questionnaire (See Appendix III) completed by the kindergarten teachers for each child and Method 3 was a battery of chiefly group tests consisting of 2 intelligence measures, 2 achievement measures and one measure of visual-motor integration:

Goodenough-Harris Draw a Person (group)
Primary Mental Abilities Test (group)
Metropolitan Readiness Test (group)
Letter Names (administered individually to each child)**
Early Detection Inventory Geometric Figures (group) ***

Method 3, the formal screening procedure, was adminis-

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* See Appendix III
** See Appendix IV
*** See Appendix V

tered by qualified school personnel, the school psychologist and the reading specialists, as well as 2 Harvard interns.

The research team constructed an elaborate screening inventory (See Appendix IV) which was not used in the study because of time factors.

Selection Process

The Selection Process had several steps, all based on the definition of Learning Disability as a deficit in learning despite intellectual, emotional, sensorial and motoric integrity. Thus a differential had to be demonstated between the child's expected performance and his actual achievement. Typically, following Myklebust, this is determined by arriving at a Learning Quotient by a procedure similar to that of the Intelligence Quotient.

$$\text{Learning Quotient} = \frac{\text{Achievement Age}}{\text{Expectancy Age}}$$

$$\text{Expectancy Age} = \frac{\text{Mental Age} + \text{Life Age} = \text{Grade Age}}{3}$$

This procedure was impossible to pursue with our early first-grade population who could not take standardized achievement tests. Nevertheless, it was necessary to demonstrate a differential between achievement and intellectual capacity in order to show specific deficiency in learning. For our population, therefore, the following ways were selected to demonstrate this deficiency:

First Consideration: Those children who showed the largest differential between reading readiness and knowledge of letter names (both representing achievement) and intelligence measures (representing potential).

Metropolitan Readiness Test score on a five-point scale from A (high) to E (low) was combined with a similar scaled score on Letter Names. The combined score was then compared to the intelligence ratings as computed by the one which gave the higher measure of intelligence: a) Average of Goodenough-Harris Draw a Man Test, representing Non-Verbal aspects and the Verbal Sub-test of The P.M.A.

or

b) Total Score on The P.M.A., which has four sub-tests, 2 verbal and 2 non verbal, i.e. 1. Verbal, 2, Numbers, 3. Spatial Relations, 4. Perceptual Speed.

Second Consideration: Those children in whom there was demonstrated the largest differential between Verbal Intelligence Score (Verbal sub-test of The P.M.A.) and The Non-Verbal (Goodenough).

Third Consideration: Scatter among non-verbal and verbal sub-tests of The P.M.A.

Fourth Consideration: The Geometric Forms Copying Test (a screening device similar to the Bender-Gestalt in that it measures visual-motor coordination) was used to refine the decision.

Fifth Consideration: Combined performance on Geometric Forms and the Spatial Relations sub-test of The P.M.A. vs. all Verbal measures.

The computations necessary for 300 children were time-consuming and in the absence of research assistance up to this time, the process of selection was slowed down. Nevertheless, it was of utmost importance that a theoretically sound procedure be followed in the selection process, which was done in several steps:

1. The school psychologist, with the help of the B.U. intern made a selection
2. The project director made a selection independently
3. The two were coordinated, with the help of the kindergarten teachers' recommendations
4. The project director, psychologist and research intern interviewed the kindergarten teachers, discussing each child selected. These interviews with the teachers produced some changes in the selection. The most valuable contribution made by the teachers was increased

insight into the nature of the disability, causative factors, dynamics, etc.

As a result, the children were sub-divided further into categories.

1. Primary Neurogenic Learning Disabilities (L.D.)
2. Primary Psychogenic Disabilities (E.D.)
3. Combined: either L.D. - E.D. or E.D. - L.D.
4. Primary socio-economic (C.D.)
5. Combined: C.D. - E.D. or C.D. - L.D.

Random assignment to the three groups in each class (Direct, Indirect and Combined) and to the control group was made separately for each of the categories, so that there would be equal distribution. It was anticipated that some information would be gleaned as to the interaction of category with treatment in the final analysis.

Pre-Testing for Diagnosis

Placed in experimental groups within each class, the children were now ready for the experimental treatment, which was divided into two phases: 1) treatment in groups (September - February); 2) prescriptive treatment of each child according to the results of a battery of diagnostic tests (February - May). (See section called Treatment)

Concomitant with the first phase of treatment, i.e., treatment in groups, a comprehensive battery of diagnostic tests was administered to all of the 62 children in the study. With the exception of the Frostig Developmental Test of

Visual Perception, all the diagnostic pretests were individually administered by the School Psychologist, the Perceptual-Motor Specialist, the Reading Specialists, and the research team of graduate students from Boston University. The battery consisted of:

The Wechsler Pre-Primary Scale of Intelligence (WPPSI: 41 children) or the Wechsler Intelligence Scale for Children (WISC : 14 children) test, selected on the basis of age.

The Illinois Test of Psycholinguistic Abilities (ITPA) (complete)

The Detroit Tests of Learning Aptitude subtests.

- Pictorial Opposites
- Motor Speed
- Auditory Attention for Unrelated Words
- Oral Commissions
- Orientation
- Free Association
- Designs
- Auditory Attention Span for Related Syllables
- Number Ability

Waltham Motor Tasks (10 items adapted from the Lincoln-Ozeretsky Motor Survey)

Developmental Test of Visual Perception (Frostig)

Wepman Test of Auditory Discrimination

Roswell-Chall Auditory Blending Test

The pre-testing was completed by February, 1970. A careful analysis was made for each child in the three experimental groups who were placed into five individual treatment sub-groups based on modality deficits:

1. Visual
2. Auditory
3. Auditory and Visual
4. Fine Motor
5. Gross Motor

Distribution is shown in the following chart:

Whittemore School = W
Plympton School = P

Modality Deficiency	Direct W	Direct P	Indirect W	Indirect P	Combined W	Combined P	Total W	Total P	W + P
Auditory	2	1	3	3	2	1	7	5	12
Visual	0	1	1	0	0	1	1	2	3
Auditory and Visual	5	5	3	4	5	4	13	13	26
Fine Motor	4	3	3	4	2	3	9	10	19
Gross Motor	4	2	0	3	3	1	7	6	13

Results of Prescriptive Testing
Number of Children Who Fell into Each Diagnostic Category

A category omitted because of the complicated implications for treatment with only one teacher in each classroom included inter-modality integration problems, such as visual-motor, auditory-visual, etc.

Congruent with recent research, this chart shows that auditory problems were in the ascendancy in this group (Zigmond 1969, Myklebust 1960, etc.) Twelve children showed auditory problems alone, and only three, visual problems alone. In the group of 26 who had both deficiencies, the auditory was usually of greater magnitude. Interesting, too, is the greater numbers of children with fine motor problems (19) than with gross motor deficiencies (13). There were some children who were identified as having a combination of auditory, visual and motor problems. These children received treatment for all deficiencies. (See Treatment Section below)

Post-Testing

The Post-testing was conducted at two junctures:

1. Interim Post-testing; December 19-23, 1969, after the group treatment period (See phase 1 of Treatment Section)
2. Final Post-testing, May 22-29, 1970, after the individual treatment period (See phase 2 of Treatment Section)

The May testing terminated the experimental part of the study as scheduled and completed the data collection on time.

Phase 1: Interim Post-testing

The December achievement testing consisted of

1. Words and Letter Names Test
2. The Roswell-Chall Auditory Blending Test, which was also used for individual diagnosis. (See Appendix VII)

The research team and the teachers concurred that interim testing would have to be minimal because the children had been in treatment Phase 1 for only 3½ months. There was general agreement that a word list from the Basic Instructional Program (of which the Ginn readers was a part) would be selected for this testing. Ability to identify letters by names would again be administered. By this time, too, the children should have started to blend sounds into words. The Roswell-Chall Auditory Blending Test analyzes the ability to blend in three ways: c - a - t, c - at, and ca - t.

In summary, the two tests in the Interim Post-Testing battery, administered in December, 1969, were the criterion measures for Phase 1 of the treatment, which was done in the three groups as randomly assigned in each of the two experimental classes, i.e., Direct, Indirect, and Combined (See Treatment Section)

Phase 2: Final Post-Testing

The May achievement testing was conducted in groups, using published tests, with the exception of the Waltham Motor Tasks, the abridged adaptation of the Lincoln-Ozeretsky. The number of children who took the final post-tests was 59, since three had moved from Waltham during the year.

The tests administered in the final May battery were:

The Metropolitan Achievement Test, Primary Level Form A

The Gates McKillop Diagnostic Reading Test, Forml

Subtests:

I. Oral Reading

III. Words: Untimed Presentation

V. Knowledge of Word Parts

Giving Letter Sounds

Naming Capital Letters

Naming Lower-Case Letters

VI. Recognizing the Visual Form of Sounds

Initial Letters

Final Letters

Vowels

VII. Auditory Blending

VIII. Supplementary Tests

Spelling

Oral Vocabulary

Frostig Developmental Test of Visual Perception (2nd administration)

Waltham Motor Tasks (2nd administration)

See Appendix VIII)

Results of these tests are given in two ways in this report. (See section called Results)

1. In the Analysis of Variance for comparison of the

four treatments with Metropolitan Achievement Test subtests, i.e., Word Knowledge, Word Discrimination, Reading, and Arithmetic scores and the scores on the Oral Reading section of the Gates McKillop Diagnostic Reading Test.

2. In the Correlation Matrices, in which the predictive power of the pretests is measured against scores on the outcome measures.

Treatment

Treatment was divided into two phases, as was final testing, described above:

Phase 1: Treatment in randomly assigned groups according to the major goal of this research:

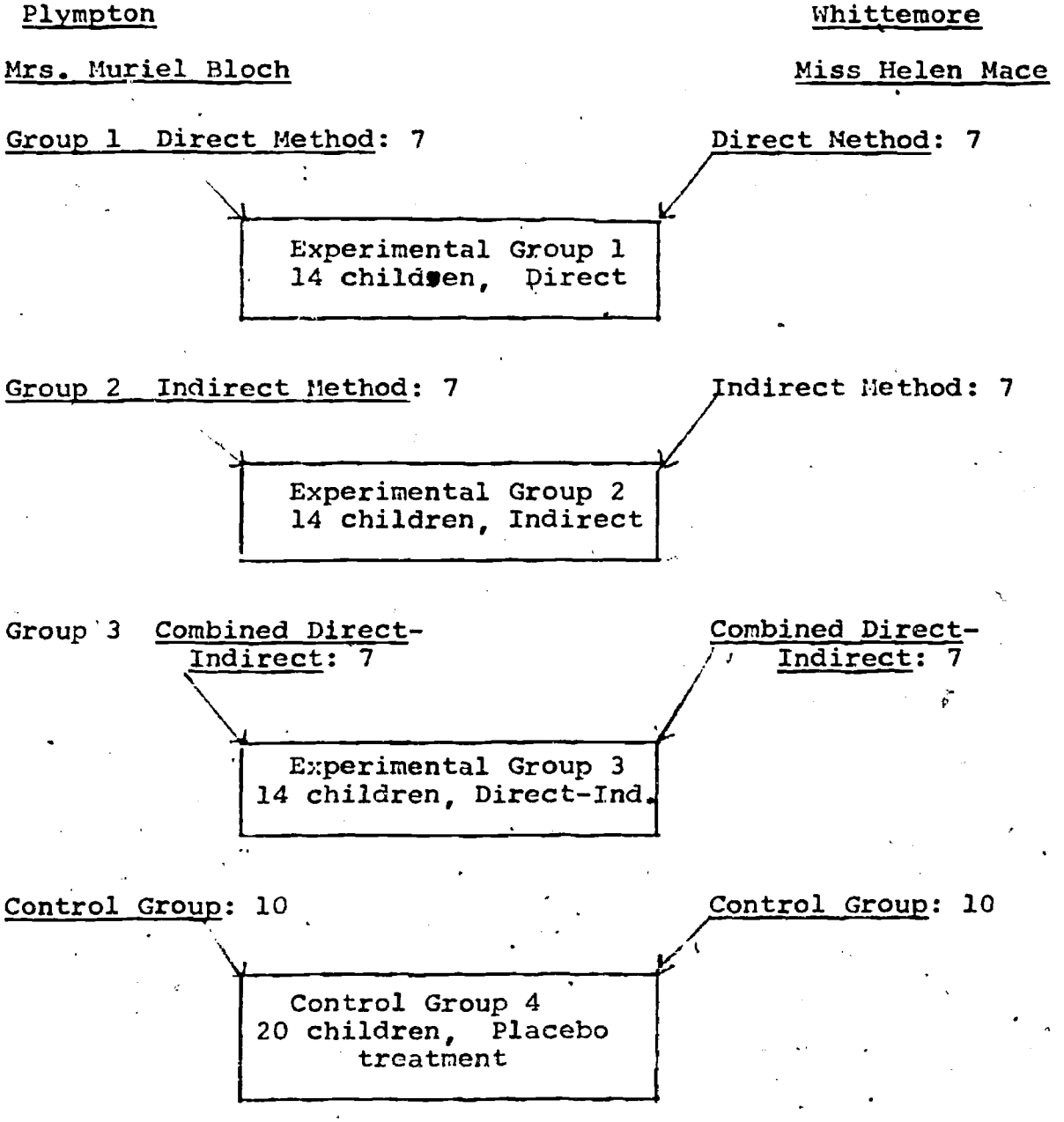
1. Direct teaching of Reading
2. Indirect teaching, i.e. perceptual-motor training
3. Combined treatment, the time allotment divided into two equal parts
4. Control or conventional teaching.

All of these methods will be described below. Phase 1 started on September 22 and continued to February 12, the onset of the spring vacation.

Phase 2: Treatment within the rationale of these four groups, but personalized according to diagnosis, and prescribed for each child. This phase started on February 22, after the spring vacation, and continued to May 22, when the final posttesting started.

Treatment

Two 2 1/2 hours a week, 1/2 hour a day, were devoted to the experimental method, in the two schools, resulting in 3 experimental groups of 14 children each and a control group of 20:



Description of the Treatments

Phase 1 . Group Treatment

Direct Method: The 14 children, 7 in each school, who had been randomly assigned to the Direct Group were taught according to the Distar Reading Method, developed by Siegfried Engelmann of the University of Oregon and Elaine C. Bruner. The time allotment was 1/2 hour per day, or 2 1/2 hours per week.

The method concentrates on basic word attack skills. Sound-symbol equivalence is stressed; the symbols are learned as sounds. Take-home materials are distributed for practice of daily lessons. Each task is analyzed in the program and taught directly, with immediate reinforcement. A teacher's kit and guide give exact instructions, so that the teacher's verbalization both in presentation and reinforcement is set down for her.

A detailed description of this published program may be obtained by writing to Science Research Associates in Chicago.

Indirect Method: Those 14 children, 7 in each of the two schools, who were assigned to the Indirect Method, received one-half hour of perceptual-motor training per day, i.e., two and one-half hours a week. This training was given by the Perceptual-Motor specialist who combined some techniques of her own with those of Kephart, Vallett, etc. She used the walking-board, as well as gross-motor activities involving balance, rhythm, body awareness, and general motor coordination. The children left their classrooms and worked in the gymnasium area

of each school.

Combined Method: The 14 children, 7 in each school, assigned to the Combined Method, received 1/4 hour of the Distar method which emphasized direct teaching of reading, and 1/4 hour of perceptual-motor training. The classroom teacher taught Distar and the perceptual-motor specialist worked with them in the gymnasium area. Thus the 1/2 hour per day time limitation remained the same for all three experimental groups.

Control Group: Ten children in each of the two schools were assigned, from the identified high-risk group of 62, to act as the Control Group. They were scattered throughout the non-experimental first-grade classes.

In order to avoid the Hawthorne effect from giving the three experimental groups an advantage known to accrue because of experimentation alone, the control group of 20 received special treatment in two ways:

1. After they were screened into the "high-risk" group of 62, all the diagnostic and criterion tests were administered to them during the pretest, interim post and final post test of batteries.

2. The special "treatment" they received consisted of walks or listening to music twice a week. It should be reported that control group treatment was sporadic at times because a teacher assistant or college student intern was necessary in each school, and there were periods when it was difficult for the principals to provide this extra person. Nevertheless, it was observed that this group of 20 children did feel part

of the general "specialness" of the project.

Phase 2 Individualized Treatment

The individualized treatment was prescribed on the basis of analysis of the diagnostic pretests administered from September to February, during Phase 1 of the Treatment.

By the school vacation in February, all diagnostic pretests had been completed. The Boston University Research Group used the vacation to analyze the individual deficit areas of each child according to the diagnostic battery. Prescriptive teaching began immediately after the vacation and continued until the May final testing period began.

Each child was diagnosed for 1) auditory, 2) visual, 3) auditory and visual, 4) fine motor and 5) gross motor problems. Inter-modality problems, such as visual-motor and auditory-motor and auditory-visual integration were noted but teachers received prescriptions only for the five major deficiencies (See testing section for chart showing numbers of children in each diagnostic group) Since some children fell into more than one category, the teachers were asked to include them in each appropriate treatment.

During this individualized treatment period, the boundaries between Direct, Indirect and Combined were adhered to.

The Direct Group continued with Distar and were trained in the deficit modality using letter forms and sounds and word forms and sounds. Motor training was devoted to kinesthetic approaches of letters and words. The Indirect Method trained auditory, visual and motor areas by devices other than direct stress on visual and auditory symbols of reading and numbers

Appendix IX contains the strategies given to both teachers for working with these children according to the modality affected. The list of suggested activities in this appendix is divided into five prescriptive areas:

1. Strategies for Remediation of Auditory Problems
2. Strategies for Remediation of Visual Problems
3. Strategies for Remediation of Fine Motor Problems
4. Strategies to Improve Cognitive Skills
5. Strategies to Improve Intermodality Transfer

In addition, audio-visual materials were suggested for the groups, e.g.: (See Appendix XI)

	Direct	Indirect
Auditory	"Listen and Do" Phonics records	"Sights and Sounds for the Deaf"
Visual	Matching of Letters Words	Film Strips for Sights and Sounds. Frostig (2,3,4,5) Matching geometric figures
Auditory and Visual	Talking Books with Film Strips	
Motor	Tracing of letters, words felt sand sandpaper blackboard	/Perceptual-motor treatment continued/

This individualized period of Phase 2 Treatment was difficult to put into effect. Assistant teachers would be necessary and additional pre-training of teachers essential for this period to be fully productive.

Basic Program

The experimental treatment as previously indicated, lasted 1/2 hour a day. The rest of the day was devoted to a basic first-grade program. Although no comparisons were scheduled to be made between the two classes, one in Whittemore and one in Plympton, it nevertheless seemed important for the basic programs to resemble each other as much as possible, although the teacher variable would persist.

In order to accomplish this, the first two weeks in September, 1969, were devoted to discussion among the director and the two teachers of a basic program. The teachers kept logs for several days and then produced a schedule compatible to both.

The experimental treatments were fitted into the mornings between 8:30 and 10:30 with the perceptual-motor specialist shuttling between the two schools and alternating weekly the school she worked in first. She devoted 3/4 of an hour to each, 1/2 hour to the Indirect Group and 1/4 hour to the Combined Group.

For the rest of the day the basic materials decided on for both classes consisted of primarily Ginn Basal Readers and Arithmetic and Social Studies curricula typical of the school system. Since the basic program is not part of the experimental research and was kept the same in both schools, it will not be described here in detail.

Results and Discussion

The two major questions posed in this research related to:

1. Group comparisons, i.e. the relative effectiveness of the four methods used in the treatment of S.L.D. children.
2. Achievement prediction, i.e. the relative effectiveness of a number of instruments widely used for predicting the achievement of children suspected of having learning problems.

Question 1 : To compare the outcome of the four methods, a one-way analysis of variance was applied.

The relative effectiveness of the four methods must be looked at from the vantage point of two post test batteries, one given at the end of December, the other at the end of May.

a. Interim Post Tests, administered in December, 1969, after approximately 3 to 3½ months (see timetable) of group instruction in each method.
b. Final Post Tests, administered in May, 1970 after approximately another 3½ months of individualized instruction in each method. During this second instructional period, each child was treated according to his specific needs as determined by a battery of diagnostic tests.

a. Interim Post Tests (December, 1969)

Since instructional time had been so short (since September 22) the research team agreed that only two simple tests would be administered: 1) The Roswell Chall Auditory Blending Test and 2) Word Recognition and Letter Naming, a test constructed by the two teachers for the project (see Appendix VII).

The results of the Roswell Chall Auditory Blending Test can be seen in Table 1. There were no statistically significant differences among the four groups. This may be because either (a) the remediation technique did not make any difference with this population or (b) the experimental groups were so small that the power of the statistical procedure was minimized or (c) the instructional period was so short that there was no time to effect large differences.

Nevertheless, it is interesting to note that there was a definite trend in the three parts of the Roswell Chall Auditory Blending Test. Despite lack of statistical significance, the mean of the Combined Method was consistently highest in all three parts (See Table 1). Also the results of Direct Method were second best on two of the three parts. These differences may be due to the fact that both the Direct and Combined Methods spent time specifically on blending of phonemes into words.

On the second Interim Post Test, Word Recognition and Letter Naming (Table 2), even in the short period between September and December, statistical differences were achieved consistently favoring the Indirect Method with the Combined

Method always second, the Direct third and the Control group last. In the subtest Word Recognition these differences were at the .001 level; in the Upper Case Letters subtest, at the .10 level; and in the Lower Case Letters subtest, again at the .10 level.

These results favor the theoretical approach of Kephart, Frostig, Vallett, Myklebust & Johnson, etc., that training in perceptual motor skills is effective at the age studied, which is in the pre-operational stage in Piagetian terms. It may be preferable to defer Reading, a complex cognitive skill, to a later age and stage for this group of "high-risk" children. Caution must be exercised to limit this finding to the age and type of the population sample in this study. The results clearly suggest early perceptual motor training for high-risk children.

b. Final Post Tests (May, 1970)

At the end of the instructional year (after a period of group instruction in the experimental methods and an additional period of individualized instruction according to diagnosed needs within each experimental method for each child) three achievement tests were administered

1) The Metropolitan Achievement Test (see Table 3)

2) The Durrell Listening Test (see Table 4)

3) The Gates McKillop Diagnostic Reading Test (see Table 5)

In general, there seem to be few significant differences between the four groups. This may be either, as previously stated, (a) because the remediation technique does not make any difference or (b) because the small size of the sample makes it difficult to detect differences by these tests or (c) because seven to eight months of instruction is too short a period for statistical differences to occur or (d) because none of the treatments is appropriate, suggesting that a still different approach emphasizing cognitive growth may be more appropriate.

A closer look at the subtests reveals some interesting results.

1. On the MAT, the Arithmetic subtest scores did show a significant difference at the .05 level, favoring the Indirect Method. The other three subtests appeared to favor the Indirect and Combined Methods also. Again, we may interpret this finding to indicate that early motor training in Phase 1 combined with specific modality deficit training in Phase 2 of the treatment period produced results favoring success in Cognitive verbal tasks such as those contained in the Arithmetic subtest of the MAT. Once more, one may apply a Piagetian interpretation that motor activity in the pre-operational period may be related to cognitive growth. There is still the possibility that stress on direct cognitive training might have been more effective than any of the methods used in this study.

Although there were no significant differences in the

Durrell Listening Test, there was again a slight diffence favoring the Indirect Method.

The Gates McKillop Diagnostic Reading Test results reported at this time focus only on the Oral Reading subtest, which of all the subtests is particularly relevant to an over-all report of the Waltham project. Other subtest results will be reported in the future.

On this Oral Reading subtest there were no significant results. However, a trend is shown toward the Combined Method first, with the Indirect Method second and the Control and Direct Methods trailing behind.

In a more detailed analysis of the Oral Reading subtest no significant differences were seen among the four methods in the following errors: additions of words, repetitions, mispronunciations, full reversals, reversal of parts, total wrong words, wrong beginnings, wrong middles, or wrong in several parts. These errors are therefore not included in Table 5. However, there were statistically significant differences in two errors: 1) omissions of words and 2) wrong endings.

Omissions of Words favors the Direct Method at the .10 level and Wrong Endings favors the Direct Method at the .10 level. Thus, the Direct Method appears to have better results in oral reading, possibly because oral reading is a typical activity in the method itself. However, it should be pointed out that one could have expected at least one significant result just by chance.

In general, the statistical differences indicated are minimal in a test as long and time-consuming to administer as the Gates McKillop. Since it was constructed for individual diagnosis only, it would appear that its use should be limited to its original purpose, i.e. individual diagnosis of errors.

In considering the treatment group differences on both the Interim Post and Final Post Tests, it is worth noting that the level of achievement of the Control Group was roughly equivalent to that of the Direct Group. This outcome is not surprising since the Control Group of 20 children were distributed in non-experimental first grade classrooms, where direct teaching of reading is traditionally used.

Table 1

Analysis of Variance: Comparison of Four Methods, December, 1969 Roswell Chall Auditory Blending Test (Interim Post Test)

Roswell Chall Auditory Blending Test	Group: Direct Method N = 12	Indirect Method N = 13	Combined Method N = 13	Control N = 19	F 3.53
Part 1	22.25 (8.61)*	21.46 (7.61)*	24.69 (5.51)*	20.37 (9.66)*	.70
Part 2	19.50 (10.28)*	18.00 (8.65)*	24.00 (6.34)*	20.68 (8.92)*	1.05
Part 3	16.50 (8.53)*	13.62 (8.54)*	21.23 (6.29)*	16.37 (10.40)*	1.57

*standard deviation

Table 2

Analysis of Variance: Comparison of Four Methods
December, 1969 Achievement: Word Recognition
and Letter Naming
(Interim Post Test)

	Group				
Word Recognition and Letter Naming	Direct Method N = 12	Indirect Method N = 13	Combined Method N = 13	Control N = 19	F 3.53
Word Recognition	29.50 (23.36)*	62.31 (38.89)*	50.31 (28.39)*	17.05 (16.29)*	7.98***
Upper Case Letters	55.50 (18.43)*	111.00 (132.70)*	68.77 (14.48)*	45.95 (23.94)*	2.52**
Lower Case Letters	55.25 (13.61)*	98.08 (110.71)*	61.85 (15.46)*	40.11 (59.21)*	2.71**

* standard deviation
*** statistically sigfiificant at the .001 level
** statistically significant at the .10 level

Table 3

Analysis of Variance: Comparison of Four Methods, May, 1970 Metropolitan Achievement Test

(Final Post Test)

MAT TEST	Group: Direct Method N = 12	Indirect Method N = 11	Combined Method N = 13	Control N = 19	F 3.51
Word Knowledge	21.83 (7.79)*	27.18 (5.24)*	27.08 (7.21)*	23.53 (7.73)*	1.59
Word Discrimination	20.67 (8.25)*	25.64 (4.46)*	26.62 (8.09)*	22.74 (8.31)*	1.48
Reading	18.83 (7.95)*	23.73 (7.11)*	21.08 (6.47)*	18.37 (6.96)*	1.43
Arithmetic	37.17 (13.10)*	51.18 (6.89)*	47.39 (11.37)*	42.84 (10.82)*	3.40**

* standard deviation

** statistically significant at the .05 level

Table 4

Analysis of Variance: Comparison of Four Methods
May, 1970 Durrell Listening Test
(Final Post Test)

Durrell Listening Test	Group				$F_{3.51}$
	Direct Method	Indirect Method	Combined Method	Control	
	N = 12	N = 11	N = 13	N = 19	
	16.17 (6.36)*	19.67 (3.68)*	18.85 (6.20)*	16.16 (7.27)*	1.03

* standard deviation

Table 5

Analysis of Variance: Comparison of Four Methods, May, 1970 Gates-McKillop Diagnostic Reading Test (Final Post Test)

Oral Reading	Direct Method	Indirect Method	Combined Method	Control	F 3,51
	N = 12	N = 11	N = 13	N = 19	
Oral Reading Total Score	30.75 (37.63)*	52.91 (39.73)*	73.15 (62.03)*	47.57 (38.94)*	1.74
	N = 8	N = 7	N = 9	N = 15	F 3,5
Omissions of Words	46.38 (29.68)*	23.14 (13.11)*	21.56 (15.87)*	19.80 (25.26)*	** 2.40
	N = 8	N = 9	N = 9	N = 12	F 3,34
Wrong Endings	7.38 (5.89)*	3.00 (2.94)*	3.00 (1.49)*	3.91 (2.18)*	** 2.82

* standard deviation

** statistically significant at .10 level

2. Achievement Prediction

The second question posed in this study relates to the relative effectiveness of a comprehensive battery of commonly used tests in the identification of children suspected of having learning problems. (See the Procedure Section for a list of the tests administered and how they were applied in this study)

In order to investigate the power of these tests in predicting achievement, raw scores on four subtests of the Metropolitan Achievement Test were used as criterion measures, i.e. Word Knowledge, Word Discrimination, Reading and Arithmetic.

The correlations showing relative effectiveness in predicting future achievement are shown in Tables 6 - 18. From a study of these tables, it was possible to select those tests and even more specifically those subtests which had predictive power for this sample of suspected "high-risk" children. In general, it was noted that selected subtest scores were often more helpful than total scores of a whole instrument.

On the basis of a close perusal of the 13 tables (6 - 18) taken from the correlation matrix, it is possible to come to the following conclusions:

1. In general, the correlation coefficients were low even when statistically significant. There were some notable exceptions to this generalization. Some of the most outstanding of these exceptions are the following subtests which were significant at the .001 or the .01 level.

a) In the Detroit Tests of Learning Aptitude, the Numerical

Ability subtest predicted achievement in Word Knowledge (r = .64), Word Discrimination (r = .56), Reading (r = .38), and Arithmetic (r = .56). (See Table 17)

b) The Primary Mental Abilities Total I.Q. predicted Word Knowledge, Word Discrimination and Reading all at the .001 level.

The Numbers subtest of the P.M.A. predicted achievement in all four achievement areas at the .01 level. (See Table 6)

Letter Names, Upper and Lower Case, predicted Word Knowledge and Word Discrimination at the .001 level. (See Table 16)

2. Table 18 gives the results of the Teacher Ratings as predictors. As other studies have indicated, the kindergarten teachers' judgments as shown in the Teacher Ratings were more powerful predictors than any of the tests administered.

Since these Teacher Ratings are evaluative in nature one must recognize that in this study the predictive power of teacher evaluation exceeded that of measurement by tests. Some of the items on the Teacher Rating Scale, such as gross motor clumsiness, hyperactivity, and poor peer relationships were strong predictors for all four areas of achievement tested on the Metropolitan Achievement Test at the end of the year.

It might be intuitively observed that a child who is clumsy and hyperactive might well have a problem in relating to his peers, and probably to his parents as well; one might

therefore hypothesize a causal interaction among these three items.

Difficulty with numerical concepts, space perception problems and speech disorders observed by the teacher are all good predictors of three achievement criteria on the M.A.T. (all except Reading).

3. Five instruments proved to be non-predictive of future learning in this group of high-risk children:

a) The P.M.A. Verbal Subtest

b) The Goodenough Draw-a-Man Test

c) The average of the P.M.A. Verbal and the Goodenough (which was anticipated might prove to be a good predictor)

d) The Wepman Auditory Discrimination Test

e) The Illinois Test of Psycholinguistic Abilities

In each of these tests less than 10% of the observed correlations were statistically significant, i.e. not above the chance level.

The WISC, administered to 14 children and the WPPSI, to 41, were relatively low in predictive power. In this connection, it is interesting to note that despite the low predictive power of the WISC as a whole, some of the subtests highest in predictive ability in the entire battery were parts of the WISC, i.e. Digit Span for Word Discrimination ($r = .45$), Reading ($r = .49$) and Arithmetic ($r = .75$); also the Arithmetic WISC subtest which related to achievement on the MAT in Word Discrimination ($r = .50$), Reading ($r = .48$) and Arithmetic ($r = .50$). (Tables 10 and 11)

Hard to explain is the high negative correlation between the WISC subtest Object Assembly and MAT: a) Reading ($r = -.51$) and b) Arithmetic ($r = -.73$). No explanation for these negative relationships comes to mind at this time.

It is important to note that although a test is not predictive for these "high-risk" children, it may be quite appropriate and useful as a diagnostic instrument. The Wechsler scales, for example, are widely used to diagnose learning problems and to elicit projective material as well. The I.T.P.A. may also prove to be useful in diagnosis and treatment, but there is not yet sufficient research on the revised edition to make an unequivocal statement.

4. From the Waltham data, it is possible to state generally that achievement in Word Knowledge and Word Discrimination are easier to predict than are Reading and Arithmetic. This observation can be explained by the fact that Reading and Arithmetic are complex cognitive skills and require more integration of thought. Poor word knowledge and poor word discrimination are relatively easier to observe during the kindergarten year than cognition and thought.

5. An important finding in this research is the relative value of number tests as predictors, as compared with other types of tests. Examples of this high predictive power of numerical tests are:

a) Numbers subtest of the P.M.A. which correlates with Word Knowledge ($p < .01$), Word Discrimination

(p = <.01), Reading (p = <.01) and Arithmetic (p = .01).

b) The Numerical Ability subtest of the Detroit Tests of Learning Aptitude which correlated with Word Knowledge (p = <.001); Word Discrimination (p = <.001); Reading (p = <.01); and Arithmetic (p = <.001).

c) Numbers subtest of the Metropolitan Readiness Test, which correlated with Word Knowledge (p = <.01); Word Discrimination (p = <.01); Reading (p = .05) and Arithmetic (p = .05).

d) Although the Arithmetic subtest on the WPPSI showed little predictive power, the Arithmetic subtest on the WISC predicted achievement on Word Knowledge, Word Discrimination and Arithmetic on the Metropolitan Achievement Test, all at the .05 level.

6. As mentioned above under the discussion of Analysis of Variance, the Indirect Method and the Combined Method were more effective in terms of the achievement of the "high-risk" children in the sample studied. It is interesting to find, therefore, that only 3 of the 9 motor tasks in the Waltham Motor Test had strong predictive capacity:

a) Sense of rhythm (p = <.001) for Word Knowledge, Word Discrimination and Arithmetic as well as for Reading, (p = <.10).

This finding is contrasted with the Teacher Rating Scale

on which teacher estimate of dysrhythmia predicted only Arithmetic achievement on the MAT ($p = <.05$). It is difficult to explain this discrepancy except by hypothesizing that poor rhythm is not overtly visible and requires testing rather than teacher evaluation.

b. The Hand-Eye Coordination subtest of the Waltham Motor Tasks predicted achievement on Word Knowledge ($p = <.05$); Word Discrimination ($p = <.01$) and Arithmetic ($p = <.01$), but not Reading.

c. The Fine Motor Coordination subtest of the Waltham Motor Tasks related to Word Knowledge ($p = <.10$); Word Discrimination ($p = <.05$) and Arithmetic ($p = <.05$), but not to Reading. (See Table 13)

7. The Metropolitan Readiness Test is an instrument widely used to predict "readiness" to read, i.e. achievement potential (See Table 9) shows that with the exception of the Numbers subtest already mentioned as sensitive to future achievement in all four achievement areas on the MAT, no other subtest is an effective predictor. In fact, the Matching Subtest had a slight negative relationship with future achievement on the MAT. However, the Metropolitan Readiness Rating, or total score is a relatively good predictor for all four MAT subtests, i.e. Word Knowledge and Word Discrimination both at the .01 level and Reading and Arithmetic at the .05 level.

Another widely used test, the Frostig Developmental Test of Visual Perception, showed no predictive power for Reading and Arithmetic at all. The Perceptual Rank (total score) and the Perceptile Rank did, however, predict achievement in Word

Knowledge ($p = .01$) and in Word Discrimination ($p = .01$). The scores on the five individual tests, Eye Motor, Figure Ground, Shape Constancy, Position in Space and Spatial Relations, were ineffective in predicting with a few minor exceptions. (See Table 12)

Summary

The following are some of the study's general findings:

1. The correlations cited, although statistically significant, are relatively low. This can be explained partially by the fact that the sample in the study was selected for its suspected learning problems. Thus it is a relatively homogeneous group of children and this restriction would result in somewhat lower correlations. The rank order, however, would probably remain the same.

2. The outcome of the analysis of variance indicates that the Indirect and Combined groups showed better achievement during the experimental year than did the Direct and Control Groups. As stated under Procedures, the Distar Method (Engleman) was selected for the Direct Group. This method was based on task analysis in reading and a system of immediate reinforcement. It undoubtedly had greater resemblance to the usual methods of teaching reading through phonic approaches such as the Control Group experienced in traditional classrooms. Thus, it resembled also the basic reading program in the two classes (see Procedures) and was "more of same" and thus less effective than the Indirect Method and the Combined Method which devoted time to perceptual motor and modality deficit training.

3. This study was limited to first graders ranging in age from 5½ to 6 when the study started. The results are interpretable only in terms of this age group of selected "high-risk" children. If achievement in Reading and Arithmetic are considered (in Piagetian terms) related to the attainment of the concrete operational developmental stage, the relative effectiveness of motor training is theoretically sound at the age and stage of this sample.

4. This study highlighted the importance of number tests and teacher ratings. Generally, with certain exceptions, these two procedures indicated the greatest predictive power.

5. The time spent on the experimental methods was 1/2 hour every day. This limitation was dictated by school procedures and the limited availability of the Perceptual-Motor Specialist. It may well be that more intensive treatment e.g. two one-half hour periods per day, might have proven more effective.

6. Another generalization that might have affected the results as reported is that the Indirect Method during Phase 1 of the treatment period was done by the Perceptual-Motor Specialist. On the other hand, the regular teachers had to be trained for the Direct Method. When Phase 2, the individualized treatment period was reached, the Perceptual-Motor Specialist continued to do the motor training and the classroom teacher was required to individualize for each method in the diagnosed weak modalities of each child. Far more extensive preparation should have been given to the classroom teacher

had there been a year, or at least a one-half year preparatory period prior to the onset of the project.

7. The most predictive tests were:

   a) All number pretests

   b) Teacher ratings

   c) Total Metropolitan Reading Readiness Rating

   d) Knowledge of Letter Names

If these were combined in a multiple prediction, results might be even more powerful for prognosis of achievement in high-risk 6 year old children.

8. This study concentrated on the differences between Direct, Indirect, Combined and Control groups as defined. It reported on the relative effectiveness of these groups in a) treatment, b) achievement prediction.

One must be careful to include in the interpretation of the resulting differences the possibility that other treatments might be more effective than those studied. For example, this investigator feels that cognitive training according to Piagetian principles might be the most effective method of helping these "high-risk" children into the concrete operational stage. This development may well prove to be necessary before children are able to master the complex cognitive skills of Reading and Arithmetic. (Simpson, unfinished doctoral dissertation; White unpublished doctoral dissertation)

Table 6

Correlations Between Primary Mental Abilities Test (PMA) and Metropolitan Achievement Test (Post Test)

N = 54

PMA	Word Knowledge	Word Discrimination	Reading	Arithmetic
Verbal	-.04	.05	-.01	-.04
Perceptual Speed	.15	.07	.08	.11
Numbers	.38***	.36***	.42***	.42***
Spatial Relations	.13	.11	.10	-.02
Total PMA IQ	.38***	.35***	.44***	.23*
Total PMA Rating	.29**	.25*	.29**	.20

* statistically significant at .10 level
** statistically significant at .05 level
*** statistically significant at .01 level

Table 7

Correlations Between Goodenough-Harris Drawing Test (Pretest) and Metropolitan Achievement Test (Post Test)

N = 46

Goodenough	Word Knowledge	Word Discrimination	Reading	Arithmetic
Scale Score	.05	-.09	-.07	.06
Rating	.15	.06	.01	.29

Table 8

Correlations Between PMA Verbal (Pretest), PMA Verbal and Goodenough and Metropolitan Achievement Test (Post Test)

	Word Knowledge	Word Discrimination	Reading	Arithmetic
PMA Verbal N = 54	.07	.15	.27	.06
PMA Verbal And Goodenough Combined N = 45	.28*	.22	.18	.15

* significant at .10 level

Table 9

Correlations Between Metropolitan Readiness Test and Metropolitan Achievement Test (Post Test)

N = 47

MET Readiness	Word Knowledge	Word Discrimination	Reading	Arithmetic
Word Meaning	.25*	.21	.21	.24*
Listening	-.09	-.03	.03	.13
Matching	-.11	-.18	-.16	.03
Alphabet	.35**	.33**	.22	.11
Numbers	.41***	.31**	.34**	.35**
Copying	.22	.09	.13	.16
MET R.R.Rating	.44***	.42***	.34**	.31**

* statistically significant at .10 level
** statistically significant at .05 level
*** statistically significant at .01 level

Table 10

Correlations Between WISC and Metropolitan Achievement Test (Post Test)

N = 14

WISC	Word Knowledge	Word Discrimination	Reading	Arithmetic
Verbal				
Information	-.25	-.23	.12	-.06
Vocabulary	.25	.37	.02	.30
Arithmetic	.36	.50**	.48**	.50**
Similarities	-.13	-.05	-.10	.15
Comprehension	-.14	-.10	+.23	.11
Digit Span	.38	.45**	.49**	.75***
Performance				
Picture Arrangement	.24	.17	.03	.30
Picture Completion	-.08	-.02	.02	.23
Object Assembly	-.19	-.27	-.51**	-.73***
Coding	-.04	-.04	-.32	-.31
Block Design	-.19	-.19	-.15	.12
Verbal I.Q.	.17	.21	.31	.42
Performance I.Q.	-.21	-.27	-.47**	-.32
Total I.Q.	-.01	.00	-.06	.12

* statistically significant at .10 level
** statistically significant at .05 level
*** statistically significant at .01 level

Table 11

Correlations Between WPPSI and Metropolitan Achievement Test (Post Test)

N = 41

WPPSI	Word Knowledge	Word Discrimination	Reading	Arithmetic
Verbal				
Information	.16	.12	.15	.25*
Vocabulary	-.09	-.08	-.20	-.21
Arithmetic	.19	.14	.19	.33**
Similarities	-.09	-.02	-.08	.01
Comprehension	.11	.15	.02	.13
Performance				
Animal House	.25	.38***	.09	.20
Picture Completion	.40***	.38	.22	.43***
Mazes	.08	.17	.14	.11
Copying Designs	.12	.19	-.03	.14
Block Designs	.35**	.29*	.21	.18
Verbal I.Q.	.10	.09	.05	.14
Performance I.Q.	.35**	.40**	.17	.30*
Total I.Q.	.28*	.31*	.14	.27*

* statistically significant at .10 level
** statistically significant at .05 level
*** statistically significant at .01 level

Table 12

Correlations Between Frostig Developmental Test of Visual Perception and Metropolitan Achievement Test (Post Test)

N = 55

Frostig	Word Knowledge	Word Discrimination	Reading	Arithmetic
Eye Motor	.26*	.25*	.20	.06
Figure Ground	.25*	.28**	.13	.20
Shape Constancy	.09	.08	-.01	-.08
Position in Space	.21	.22	-.04	.07
Spatial Relations	.18	.20	.20	.05
Perceptual Rank (Total Score)	.35***	.33***	.13	.21
Percentile Rank	.40***	.35***	.21	.19

* statistically significant at .10 level
** statistically significant at .05 level
*** statistically significant at .01 level

Table 13

Correlations Between Waltham Motor Tasks and Metropolitan Achievement Test (Post Test)

N = 55

Motor Tasks	Word Knowledge	Word Discrimination	Reading	Arithmetic
Gross Motor Coordination	.13	.19	.09	.25*
Fine Motor Coordination	.24*	.31**	.21	.29**
Sense of Rhythm	.37****	.37****	.23*	.40****
Balance: Stationary	.11	.16	.09	.13
Balance: Locomotor	.07	.13	.00	.14
Knowledge of Direction	.16	.17	.27**	.21
Body Awareness	.02	.06	.20	.33***
Hand-Eye Coordination	.27**	.32***	.20	.33***
Mid-Line Transfer	-.05	.06	-.09	.19

* statistically significant at .10 level
** statistically significant at .05 level
*** statistically significant at .01 level
**** statistically significant at .001 level

Table 14

Correlations Between Illinois Test of Psycholinguistic Abilities and Metropolitan Achievement Test (Post Test)

N = 55

ITPA	Word Knowledge	Word Discrimination	Reading	Arithmetic
Auditory Reception	-.07	.01	-.10	-.18
Auditory Association	-.02	-.03	.03	.14
Verbal Expression	-.14	-.04	-.01	.12
Visual Reception	-.01	-.04	-.01	-.14
Manual Expression	-.09	-.17	-.08	-.21
Auditory Memory	.23*	.23*	.04	.34***
Grammatic Closure	.15	.15	.16	.23*
Visual Memory	.07	.11	.16	.22
Visual Closure	-.10	-.04	-.14	-.23*
Visual Association	-.08	-.09	-.04	-.09
Auditory Closure	.04	.06	-.09	-.12
Sound Blending	.18	.15	.31**	.07
ITPA Total (PLA)	:24*	.22	.13	.22

* statistically significant at .10 level
** statistically significant at .05 level
*** statistically significant at .01 level

Table 15

Correlations Between Wepman Auditory Discrimination Test and Metropolitan Achievement Test (Post Test)

N = 55

Wepman X/Y Rating	Word Knowledge	Word Discrimination	Reading	Arithmetic
X	.14	.13	-.01	.14
Y	.02	-.03	-.16	.20
Rating	.26*	.21	.12	.03

* statistically significant at .10 level

Table 16

Correlations Between Knowledge of Letter Names and Metropolitan Achievement Test (Post Test)

N = 46

Knowledge of Letter Names	Word Knowledge	Word Discrimination	Reading	Arithmetic
	.48****	.45****	.31**	.23

** statistically significant at .05 level
**** statistically significant at .001 level

Table 17

Correlations Between Detroit Test of Learning Aptitude and Metropolitan Achievement Test (Post Test)

N = 54

Detroit	Word Knowledge	Word Discrimination	Reading	Arithmetic
Picture Opposites	.09	.11	-.09	-.06
Motor Speed	.07	.05	-.03	-.05
Auditory Attention (unrelated)	.19	.08	.00	.09
Oral Commands	.01	-.07	-.06	.09
Orientation	.20	.09	.31**	.25*
Free Association	-.15	-.16	-.17	-.23*
Design	.50***	.38***	.21	.29**
Auditory Attention (related)	.25*	.16	.11	.36***
Numerical Ability	.64****	.56****	.38***	.56****

* statistically significant at .10 level
** statistically significant at .05 level
*** statistically significant at .01 level
**** statistically significant at .001 level

Table 18

Correlations Between Teacher Ratings and Metropolitan Achievement Test (Post Test)

N = 47

Teacher Ratings	Word Knowledge	Word Discrimination	Reading	Arithmetic
Gross Motor Clumsiness	.39****	.35***	.28**	.45****
Hyperactivity	.48****	.47****	.41****	.54****
Difficulties in Space Perception	.42****	.32**	.16	.34***
Speech Disorders	.35***	.30**	.28**	.38****
Expressive Language Deficiency	.32**	.19	.16	.12
Dysrhythmia	.12	.11	.01	.28**
Fine Motor Incoordination	.30**	.12	.26*	.20
Visual Symbolic Difficulty	.45****	.38****	.13	.22
Difficulties with Numerical Concepts	.41****	.35***	.13	.34***
Poor Peer Relationship	.49****	.57****	.33***	.40****

* statistically significant at .10 level
** statistically significant at .05 level
*** statistically significant at .01 level
**** statistically significant at .001 level

Recommendations for Future Research

The Waltham Project produced considerable information about children with learning problems of the type selected for the six-year old group in the two classes studied at The Whittemore and Plympton Schools. Two major findings were reported at this time.

1. The Project investigated in the same population the relative predictive power of a comprehensive number of instruments presently used for identification, diagnosis and proposed treatment of L.S.D. children. This is the first time such a study has been done. Relatively few of these instruments were found to be significantly related to later achievement, and therefore most of them do not predict learning problems. There were two notable exceptions which did show high predictive validity.

   a. The Wellesley Teacher Rating Scale, an evaluative instrument administered by kindergarten teachers at the end of the kindergarten year, and

   b. Numbers subtests of several instruments, i.e. PMA, Detroit Tests of Learning Aptitudes, Metropolitan Readiness Test, and the WISC. The Metropolitan Readiness Test total rating proved useful as well.

This general statement about the paucity of predictive power of most of the instruments studied must not be interpreted to deny their possible clinical usefulness for diag-

nosing the strengths and weaknesses of individual children. (See the preceding section for a detailed analysis of the relevant data)

2. The Waltham Project investigated four methods of remediation on reading, i.e. Direct, Indirect, Combined and the conventional methods. The criterion measures used for comparing achievement were mean scores on four subtests of the Metropolitan Achievement Test, Primary Level, i.e. Word Knowledge, Word Discrimination, Reading and Arithmetic.

The data already analyzed revealed several more findings which will be reported in the future after additional processing and analysis:

a. The effectiveness of the experimental methods in other achievement areas: e.g. Handwriting and Spelling, two areas of achievement generally regarded as particularly sensitive to prediction and diagnosis of learning problems.

b. The effect of the methods on motor skills, as shown by a comparison of pretest and post test scores on the Waltham Motor Tasks.

c. The effect of the methods used on five visual discrimination skills pre- and post-tested by the Test of Visual Perception (Frostig).

d. The effect of the methods used on several other skills post-tested in the final May battery on the Gates McKillop Diagnostic Reading Test, i.e.

1) Auditory Blending

2) Oral Vocabulary

3) Recognition of the Visual Forms of Sounds

In addition to this information implicit in the data already processed and ready for analysis, the study has heuristic potential. Some studies that come to mind are:

a. It is recommended that this study be replicated with a larger group of children, e.g. screening the whole kindergarten population of a town or city, and remediating all those in whom learning disabilities are predicted by the same four methods to determine if the general results are similar to those of this study.

b. Since correlations were generally relatively low in both the predictive part of the study, and in the analysis of variance between methods, a large part of the variability is still not accounted for. It would be important to determine what other variables are contributing to these differences.

3. Only three experimental methods were investigated in this study. A higher F ratio might be attained if still other methods were tried. Since Reading and Arithmetic, the more complex cognitive skills, were more difficult to predict and had lower correlation coefficients in the analysis of variance, it may be that methods stressing cognitive development would be more effective.

The suggestion is made that treatment based on the Piagetian transition from the pre-operational to the operational

stage might be more effective than the treatments investigated in this study.

Several European and Asian countries delay the start of reading instruction until the age of seven, based on this maturational stage approach, as did many American schools during the "Progressive Education" period. It would be most interesting to try methods consonant with the innate development of children on a larger scale than has been attempted thus far (Levi, 1969; Kamii 1970; etc).

4. If after replication, the ITPA continues to prove generally non-predictive, it is recommended that it be investigated as a diagnostic tool. Remediation in low-score subtest skills, should then be tried to see if improvement in these areas improves learning capacity. The time element in the ITPA makes it important to justify its use.

5. A study should be done of the relative accuracy of the three screening devices used in this study. (See "Screening" in the section called Procedures in this report). These three screenings should be evaluated and a judgment made on the basis of effectiveness, economy in time, available personnel, cost, etc.

From the observation of the research team, the teachers were most relaxed in making the spontaneous judgment. The Teacher Rating Scale made them tenser and they spent considerable time and thought in determining each item for the 30 or so children in each class.

The group screening and testing program started in May, 1969 and continued in September, took a great deal of time and effort. All these aspects should be considered.

In judging the actual accuracy of the selections made, achievement scores on the whole population screened (approximately 300 children) would be needed. This judgment should, therefore, be done when the entire population gets its first routine school-wide achievement test battery at the end of the second or third year.

It may be optimally effective to combine some standardized screening procedures with teacher judgment.

6. If the study is replicated on a larger population, it would be most interesting to study the interactions of the sub-classifications of the children by etiology (neurogenic, emotional, cultural) with the methods used and the achievement outcomes. It would be important to determine the optimal method for each sub-category.

7. Several variables which were integral parts of the study as originally projected were omitted because of administrative difficulties. In a replication, it would be desirable to include them, even if budgetary arrangements are necessary:

a. Parent questionnaire. (See Appendix 10) The study was to have included information elicited from parents, such as sibling problems, para-natal problems, problems due to crises in the life of the child,

e.g. death of a parent, etc. This questionnaire was never completed because of technical problems.

b. Medical data. Neurological and pediatric examinations of each of the 62 children were to have been made. When it became apparent that this component of the study would not be included, questions concerning health were included in the parent questionnaire. Since only 16 out of 62 parents came to the meetings arranged for the purpose of filling out the questionnaire, this information had to be omitted.

APPENDIX I

"A Proposal for an Experimental Model School Program for Children with Specific Learning Disabilities" prepared by a Task Force of the Massachusetts Psychological Center

PROPOSAL FOR AN EXPERIMENTAL MODEL SCHOOL PROGRAM FOR CHILDREN WITH SPECIFIC LEARNING DISABILITIES

Introduction:

The model School Program for specific learning disabilities is proposed by the Massachusetts Psychological Center for the Waltham Public School System. It is felt that the research goal should be integrated with the operational goals the School System wishes to attain. These are: to establish a specific learning disabilities training program, with the necessary staff and facilities, to educate pupils early in their elementary grades and to determine the effectiveness of the special education. The results of the research project should provide a firm basis on which Waltham School Officials may make educational decisions and to take specific courses of action for children with specific learning disabilities. Currently, it is difficult to make wise decisions about these children because while there are many advocates of various positions, there is a dearth of reliable data bearing of the effectiveness of these positions. In practical terms this means that school systems have to decide, in the absence of scientific evidence whether to deal with the child with a specific learning disability by a direct or an indirect approach.

Before indicating how the present proposal may resolve this difficulty, it is desirable to first define the term "special

learning disabilities" and then describe what is meant by direct and indirect approaches.

Definition of Special Learning Disabilities

The definition offered by the National Advisory Committee to the U. S. Office of Education's Bureau of Education for the Handicapped states:

"Children with special learning disabilities exhibit a disorder in one or more of the basic psychological processes involved in understanding or in using spoken or written language. These may be manifested in disorders of listening, thinking, talking, reading, writing, spelling or arithmetic. They include conditions which have been referred to as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, developmental aphasis, etc. They do not include learning problems which are due primarily to visual, hearing, or motor handicaps, to mental retardation, emotional disturbance or to environmental disadvantage."

Definition of Direct and Indirect Approaches

The Direct Approach: This approach implies the application of remedial efforts directly to the specific educational deficiency a child manifests. For example, if a child has difficulty learning to read because he confuses the relationship between certain letters and their sounds, then the specialist using the direct approach brings to bear the most effective means available for establishing these relationships. Similarly, if the child has difficulty reading or writing from left to

right (frequent reversals) he is given specific training sounding-out and writing-out words in a left to right direction. Such training assumes that the direct approach will be most effective whether or not the difficulty stems from neurological, emotional, home environment, or instructional factors.

The Indirect Approach: The indirect approach assumes that the special learning disability which a child demonstrates in reading, writing or arithmetic may be most effectively corrected by training the child to coordinate his sensory-motor functioning independent of the subject in which he has difficulty. Thus, a child who frequently reverses words may be trained to track a moving object, to copy abstract designs, to walk a narrow plank backwards and forwards, etc. Such training assumes that improvement in sensory-motor coordination which results in this context will generalize to and facilitate learning in academic areas. Such training also assumes that the learning disability the child manifests has its origin in neurological impairment.

Project Plan

Although there is no experimental evidence to support the current view that the indirect approach does aid children with specific learning disabilities (SLD) in reading, writing or arithmetic, neither is there evidence to rule out its possible effectiveness contrasted with the direct approach. The proposed research attempts (1) to determine the effectiveness of both approaches for children showing severe SLD and (2) to

provide a tutorial program within the context of regular classroom activities for those children showing less severe learning disabilities. Appendix A is a schematic of the project plan which will require fourteen months for completion. It is anticipated that the project director will be a qualified psychologist from the staff of the Massachusetts Psychological Center.

Five major steps in the project plan are:

(1) Establish the program

(2) Perform the research function:
   a) identify specific learning disabilities in grade one pupils.
   b) assessment of each individual pupil showing SLD.
   c) develop performance measurements.
   d) analysis of results.

(3) Establish special education programs, staff and facilities.

(4) Perform on-going evaluation of the Model School Program.

(5) Suggest future implementation plans.

Research Design

The research design is based upon the following criteria:

(1) The ideosyncratic nature of SLD for any given pupil requires extensive evaluation of each pupil.

(2) A pre-post analysis is made on each individual pupil consistent with item 1 above. Thus, each pupil serves as his own control.

(3) Performance measures are obtained for pupils exhibiting SLD.

(4) The establishment of two matched groups of children with severe specific learning disabilities. The random assignment of these pupils to the direct or indirect educational approaches.

(5) Tailoring the tutorial and special education to the specific disabilities in question.

(6) Evaluation of overall progress by classroom and standard achievement tests, and adjustment psychometric and projective tests on each pupil.

Procedures

1. Identifying Children with Specific Learning Disabilities
In order to determine the relative effectiveness of the different approaches it is necessary not only to identify the children with specific learning disabilities, but to identify exactly the nature of the reading, writing or arithmetic disability.

a) The Teacher's rating Scale: This instrument (see Appendix) helps first grade teachers locate those children in her class who are not achieving appropriately and who manifest a variety of behavior signs generally thought to be associated with specific learning disabilities. This scale and their own observations may induce teachers to refer certain children as candidates for special learning disability services (SLDS).

b) Standardized Group Readiness and Achievement Tests: Readiness and achievement tests begin the process of isolating the nature of a child's learning disability. In addition, such tests make it possible to gain a general estimate of how serious the disability is by comparing the referred child's score with those of other children in his class. Scores on tests for all the children in a specific class as well as test protocols should be made available to the psychologist before his examination of teacher-referred children.

c) The Psychological Examination: The primary purpose of the examination is to isolate the nature of the specific learning disability. The psychologist achieves this, in part, by carefully observing the child's performance in reading, writing or arithmetic and by introducing any other tests he might require to clarify the conceptual, perceptual or sensory-motor functions which are deficient. As a secondary goal, the psychologist administers standard individual psychometric and projective tests to determine how the specific learning disability fits into the child's overall adjustment.

d) Medical Examination: This may be conducted by the family physician or pediatrician (SPED 902), or by a neurologist, opthamalogist or psychiatrist as recommended by the project director.

e) Optional Referrals: At the discretion of the Project Director these may include existing school service personnel, speech therapist, reading consultants, school adjustment counselor, social worker (home visit) or other resource.

f) Parents must sign a form permitting their children to take part in this voluntary program.

2. The Establishment of Matched Groups
Two matched groups of children with specific learning disabilities are to be established. Criteria for matching should include the following:

a) the nature of the specific learning disability, e.g., the particular facet or facets of the reading, writing or arithmetic process which requires correction.

b) Achievement Test Scores as well as readiness test scores.

c) Chronological Age, Sex, Mental Age and IQ test scores.

d) Behavior style, e.g., distractibility, hyperactivity, left-right dominance, etc.

3. The Assignment of Direct and Indirect Approaches
Once the two matched groups of children have been established, each group will be randomly assigned to one of the two approaches. This means that instead of regular classroom instruction in the area of their disability, these children will report to a classroom set aside for SLDS. (If the room in Plympton School is available, it may be scheduled at different times, for each of the two groups.)

Each group should meet for one hour session per day, five days per week with a teacher competent to teach one of the two approaches. Each group should have a different teacher assigned to it.

4. Comparing the effectiveness of the two approaches.

After six and twelve months of training on one of the two approaches, each group shall be reevaluated on equivalent forms

of all standard readiness and achievement tests previously administered. Also reevaluation by the psychologist with regard to the status of the specific learning disability shall be accomplished. We will not have any knowledge whether the child participated in the direct or indirect group. The design for this procedure appears in Table 1.

TABLE 1 GROUP EVALUATION SCHEDULE

	Evaluation		
Group	initial	6 months	12 months
Direct*	x	x	x
Indirect*	x	x	x

*Eight children in each class, with two classes in each group making a total of 32 pupils. With repeated evaluations, it will be possible to statistically test the gains achieved as a function of approach, time in program, and interactions between approach and time in program. An analysis of variance, t-test statistics or non-parametric statistics will be used wherever appropriate.

Scope

The Massachusetts Psychological Center will provide the following services during the Model School Program Project:

1) Provide a Project Director.
2) Assistance during screening and assessment of SLD cases.
3) Integrate first grade student data collected.
4) Assistance in classification of students as to degree of severity of SLD.

5) Assistance in selection of staff, training equipment.

6) Provide psychological services for screening and selecting students.

7) Provide on-going evaluation services.

8) Carry on research program.

9) Provide progress reports.

10) Write final report.

Staff Requirements

Project Director: A fully qualified Ph.D. psychologist able to organize the program, train and supervise staff as well as supervise the treatment of data. To meet these responsibilities he should be prepared to consult with the school for extended periods two times per week.

School Psychologist: An MA psychologist able to conduct examinations under supervision of the project director.

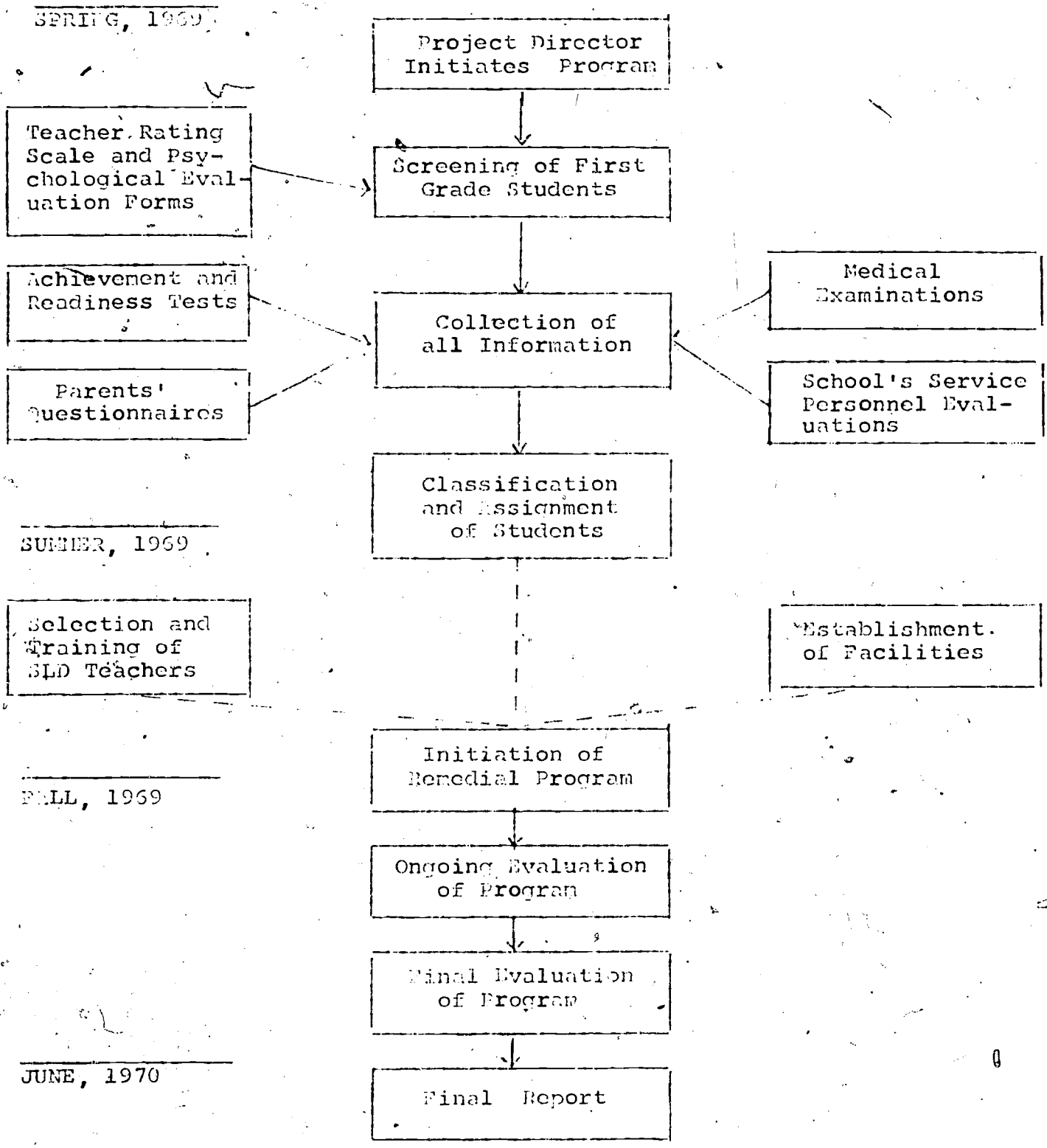
Part time Special Teachers: May be trained by the Project Director from among the school system's current staff. They should have an Elementary School Teaching Certificate and at least a special 6-8 weeks course for teachers of children with learning disabilities.

EQUIPMENT

Provision for special classroom in the Plympton School for full use by the project staff. Includes the basic furniture required for eight pupils and a teacher. Teaching materials and equipment required for the study will be purchased.

APPENDIX A

SCHEDULE FOR SPECIFIC LEARNING DISABILITIES PROGRAM



APPENDIX II a

Review of Literature

Perceptual Motor Training

(Roberta Best)

Submitted to
Dr. Blanche Serwer
May, 1970
Roberta Best

The following represents a survey of research and literature on perceptual motor training:

The issue of the efficacy of perceptual motor training as an adjunct to the teaching of reading has stirred considerable controversy. One of the foremost proponents of this training is Newell C. Kephart. Kephart (16) states that many children reach school age with incomplete ocular control which makes the acquisition of reading skills difficult if not impossible. He contends that the solution to this dilemma is in motor manipulation. A child investigates his environment motor-wise. He then experiments with the movement of his eye until it gives him information which matches his motor information. Since the body of motor information is reasonably constant, the child stabilizes the visual information when a match occurs. Through many such experiences the child develops a visual world which matches his motor world. Now all information - motor or perceptual - sensory input or motor response - is part of an overall system which gives consistent information whenever it is tapped.

To deal with symbolic materials, such as those presented in the public school (i.e.: reading, spelling, writing) the child requires a stable spatial world. Such a world can be established only through the development of a system of spatial relationships learned first in the motor activities of the child and later projected onto perceptual data.

Kephart feels (17) that much attention will need to be

given, particularly in classrooms for brain injured children, to the development of motor patterns, the achievement of a perceptual motor-match and similar skills. These activities, he posits, contribute to basic readiness skills assumed by our normal classroom methods.

In the same vein, Lawrence Gould presents his interpretation of Piagetan principles with a vision-motor-perception program which has an ancillary goal of accelerating the child's cognitive development. He states that, "Cognitive development depends on sensorimotor achievements, which, in turn, depend on the child's perceptual abilities and his capabilities to respond. These perceptual abilities are measured in terms of discrimination between various stimuli." (14)

Jean Ayers (3) has presented a detailed account of her reasoning in developing a motor training program which begins with gross motor activities.

A program for the development of visual perception has been outlined by Marianne Frostig. This consists of both gross and fine motor tasks. She has identified five areas of visual perception which her program purports to treat.

A perceptual training progression program (32) for all first grade school children has been developed under the auspices of the Winter Haven, Florida Lions Club and is available to schools throughout the United States.

Glenn Doman and Carl Delacato have perhaps attracted more public attention than any of the other proponents of

perceptual motor training. The central concept of their theory is the relationship between neurological organization and reading. At the Philadelphia Institutes for the Development of Human Potential children are patterned for creeping, crawling and sleeping. The program includes physical exercises, special diets and eye exercises. Their belief is that the development of the individual recapitulates the development of the human species (8) and that creeping and crawling are basic to all human development.

Some of the earliest research in the area of perceptual motor training and reading (27) was conducted by Betts (1934) and Eames (1942). Their studies were limited in that they used no controls. From these studies, however, they inferred that vision difficulties caused reading problems. The first good study was conducted by Witty and Kopter (1936) using controls. They found visual factors unrelated to reading ability.

The Reading Research Foundation supports the notion that some form of structured physical activity contributes to the development of a higher level of learning capacity. In a position paper included in the January, 1970 issue of the Journal of Learning Disabilities, members of the Institute quote research by Oliver (1958) and Corder (1966) which indicated that studies of emotionally disturbed, mentally retarded children showed gains in perceptual motor performance after receiving perceptual motor training. The rationale noted is that poor visual motor functions represent disorganized

neurological functions with a variety of causes. It is stated that an appropriate sequence is necessarily based on the following hierarchy:

1. Proprioceptive
2. Tactile
3. Auditory
4. Visual
5. Language

They believe that an underdeveloped and disorganized schemata equals a disorder in body image and motor coordination frequently seen in learning disabled children, (Frostig and Horne, 1964 and Kephart, 1961) and that exercises develop the schemata. They interpret the works of Piaget, Bruner and Luria as supporting their position.

A review of some of the related research follows:

In a pilot study of the immediate effectiveness of the Frostig-Horne training program with educable retardates (1), it was found that the group receiving the training showed significant improvement in figure ground perception, figure constancy and spatial relations.

Norris Haring and Jean Stables (15) found in an investigation of Kephart's closed-cycle theory, using mentally retarded children, the children showed significant gains on a test of visual perception and eye-hand coordination after engaging in a six month program of gross motor training.

A British study conducted by James Oliver (21) in which

systematic and progressive physical conditioning was used, with educationally subnormal boys, resulted in significant improvement on physical and mental tests.

Genevieve Painter, using a program of systematic rhythmic and motor activities based on Barsch's moveogenic theory and on suggestions from Kephart, worked with low-functioning kindergarten children. The results showed significant gains in body image, perceptual motor integration and psycholinguistic competence.

The above research tends to support the hypothesis that perceptual motor training improves perceptual motor performance. The results of research undertaken to assess the effects of perceptual motor training on reading are much more ambiguous:

In an experiment conducted with good readers, Norman Chansky (5) reported that, when they were given ten weeks of perceptual training these children improved in word accuracy and reading comprehension. From these results he concluded that perceptual training may be a promising technique to rehabilitate elementary school underachievers.

A play program designed to develop certain perceptual motor skills was used with kindergarten children by Rutherford (26) in an effort to determine its effects on readiness development. The children in the experimental group made significantly greater gains in reading and total readiness than did the control subjects. Some doubt clouds the results of this study. The control group was allowed almost complete free play while the experimental group spent approximately two thirds of

the period in free play and the rest in directed use of the equipment and activities. This approach then, included a language factor, attention and following direction. All of these are presumed to play a critical role in readiness.

A study of first grade children was conducted by McCormick, Schnobrich and Footlik. The children were equated on IQ and reading grade level. The experimental group received perceptual motor training for nine weeks. The reading achievement retest scores exhibited no significant differences between the two groups as a whole. However the effect of the training on the children with the lowest initial reading scores resulted in significantly larger gains in reading achievement in the experimental than in the control group. The results were interpreted as supporting the theory that perceptual motor training can facilitate reading achievement for under-achieving children. This program contained a large language component. The exercises involved the dual process of the internalization of self-control and the concentration of attention on the movements being made. The internalization process was patterned on the analysis formulated by Alexander Luria (1961) in which the child is trained to verbally command his own behavior.

That there is a relationship between visual perception and reading is indicated in a study conducted by Fuller and Ende. (13) This study used multiple and partial regression correlation tests of visual perception in combination with reading understanding and general intelligence. They found

these factors to have high predictability and diagnostic powers at the junior high level.

Sterritt (31) on the other hand, in a study of fourth grade boys found that visual perception declined in importance from third to fourth grade and auditory and/or cross modal perceptual abilities and IQ became more important in individual differences in reading ability.

A study of the Frostig Developmental Test of Visual Perception (22) as a predictor of specific reading abilities with second grade children was devised by Arthur Olson. The results of the study showed little relationship to the specific reading abilities. They seemed to have little relationship to mental or chronological age.

In a third grade study, Olson (23) found that the total Frostig test scores were a fair predictor of school achievement and specific reading skill ability and were better for girls than boys. However he notes that this study does not support Frostig's postulates concerning the relationship between individual tests and reading achievement.

A further study by Olson, instituted to determine the predictive value of the Frostig test, indicated a positive correlation of position in space and reading difficulty. There was no support indicated for figure-ground perception correlation with reading difficulty. Form constancy had no predictive value.

Carl L. Rosen (25) carried on a controlled study of visual perceptual training and reading achievement at the first grade

level. The results showed a gain in perceptual ability but no relation to reading ability. He postulates that the perceptual skills taught in the Frostig materials may be unrelated to reading abilities.

The Doman-Delacato interpretation of neurological organization was investigated, with their cooperation, by Melvin Robbins. (24) This was a controlled study investigating six of the major tenets of Delacato's theory. The sample population was made up of second grade children. The results did not support Delacato's program; the program did not enhance the reading development of the subjects. The postulated relationship between neurological organization and reading could not be supported. Robbins points out that the theory was developed from evidence gathered from brain injured children and those with reading problems. While the implication of the theory is not limited to children with reading and other language disorders, the findings of this study, based on evidence gathered from normal children, may not apply in these special cases. However, the fact that the theory was not supported by any of the findings (six null hypotheses were tested) casts doubt on its practicality and validity.

The investigator was unable to discover published reports, other than Delacato's own writings (1959, 1963) that support the theory. Verifiable empirical evidence from controlled studies, using generally accepted research methods is needed if advocates of the theory wish to gain acceptance and recog-

nition of the theory from the scientific community.

S. Allen Cohen (6) writes, "Except for extreme cases who are obviously deficient in basic schemata - so deficient that we cannot even get them to sit at a desk - most learning disability cases do have enough schemata to learn to read."

He feels that the remediation of problems in reading by restructuring the schemata have little pay off. He quotes studies by Jacobs (1969) and Kriszevski (1967) to support his postulation. The line of reasoning that he follows is that for most children the further the independent variable, for example visual perceptual development, removes from the dependent variable (reading) the less the measurable pay off in reading. Fifty years of research, he notes, proves this.

Bannatyne intercorrelated various measures of visuo-motor functioning and generated coefficients to the order of .50 and .70 . (Bannatyne 1969) In the correlations between the visual motor variable and school related tasks, the best he could find was .39 with spelling, which is not close.

Cohen guesses that auditory training is more likely to pay off because it is closer to the dependent variable. Perhaps prevention is the independent variable. Frostig and Solar may have confused teaching with learning, he feels. Researchers conclude that good teaching has gone on. This may not be so.

In a speech at the Orton Society meeting of October, 1969, de Hirsch postulated that so-called non-educational strategies

had been exposed as dead end skills. The fact that cognitive functioning has been said to have a loco-motor foundation is a distortion of the notion that thought has its origin in action. There is no evidence that peripheral exercises of hand dominance training can, in any way, effect cortical control. Motor learning is not the corner-stone of cognitive development, in spite of Delacato, Kephart, Getman and Barsch. Large muscle training does eliminate tensions and stabilize body control. It is beneficial for behavior in general but, Mrs. de Hirsch asks, "Is body training per se enough, or is it the listening and verbal mediation skills which bring the success?"

de Hirsch feels that high-risk children are immature in all sensory motor channels, and thus wonders why visual training programs should have a transfer effect. Above all, a correlation of a perceptual deficit with a "high-risk" designation in reading is not to imply a causal relationship. Too often the learning disability literature makes this error. A deficit may predict, may show a correlation with reading ability but this must not be confused with causation. Thus it is no surprise that Frostig's program shows no superiority on reading readiness measures. The only visual-perception rating which shows a correlation with reading scores is position in space.

Research on the effects of special perceptual motor training (10) as part of the general kindergarten curriculum with children in the lower two thirds of the group, was conducted by Falik. The experimental group showed no significant

gains over the control group. It is suggested that the relevance of special training for non-clinical groups must be seriously questioned.

Patrick O'Donnell (20) reported research on Delacato training for reading achievement. He states that in general the children who in this sample were given Delacato training or a modification of it did not make significantly greater gains in reading achievement or visual motor integration. He does not that, because of the limitations of the study, all of Delacato's activities were not used.

Jean Piaget, probably the world's foremost developmental psychologist, is often quoted by the proponents of perceptual motor training to the effect that all learning has a basis in motor development; that mastery of lower (perceptual motor processes) is necessarily prior to higher cognitive processes and, hence, scholastic achievement. A growing body of scholars tends to refute this interpretation. H. B. Szlewowski (33) says "Piaget ..... was of the opinion that intellectual acquisitions do not follow a linear process which might include necessary cause and effect relationships between acquisitions at a given level and those at a higher level. Piaget believes that a distinction, at all levels of cognitive functions, must be made between an operative aspect and a figurative aspect. Therefor the operational structures may not be the result of perception but instead, may be generated by a series of mechanisms originating with sensori-motor organization and giving rise to perceptive

activities which represent only one given area.

Consequently, Piaget rejects the concept of a linear relationship between primary and higher forms of organization of cognitive function to the extent that any new acquisition brings about continuous alteration and reorganization of those individual forms.

A controversy-provoking study was conducted along this line of thought by Roger Bibace and Karen Hancock. They used eight children in two age groups (7-8 and 12-13 years) (4) They classified the children as high perceptual-motor, high scholastic; low perceptual-motor, low scholastic; high perceptual-motor, low scholastic and low perceptual-motor, high scholastic. Their findings were that the means relied on for solving experimental tasks were

category		means	
P.M	Sch.	P.M.	Sch.
high	high	1	5
low	low	5	1
high	low	4	2
low	high	2	4

They concluded from the results that both younger and older children can be found who show gross deficits in perceptual-motor abilities and who, despite these deficits are able to function very well in school and who do reveal reliance on conceptual means in experimental tasks. An important point to be noted is their statement, "We suspect that such children do not often, if ever, come to the atten-

tion of clinicians and special educators." This seems a reasonable assumption since high achievers are not usually viewed by teachers as referral cases.

Some criticisms of this study are stated in the critiques. They include: choice of test, size of sample and oversimplification. However, the general trend of these remarks points to the fact that this is a fertile area for future investigation.

In summary, it might be said that, at this point in time, the proponents of the theory of perceptual motor training seem to have illustrated that such training may result in better perceptual motor functioning in children with learning disabilities. That this improved functioning results in better reading achievement has yet to be proven.

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APPENDIX II b

Review of Literature

Auditory Perception

(James McCloughlin)

Submitted to
Dr. Blanche Serwer
May, 1970
James McCloughlin

Auditory Perception

Recently there has been an increased interest in developing the auditory skills of children who are having difficulty in school. The training includes the receptive, expressive and integrative aspects of auditory skills. The reason for this interest is the realization of the auditory dimensions of learning difficulties. Techniques and programs are being developed on the basis of investigations into the auditory skill. The following is a brief review of contributions to our knowledge of the auditory skill.

We have only to consider the difficulties that the deaf have in language, communication, personality development, and academics (Myklebust, 1960) to realize the import of the auditory upon normal development. Zigmond (1968) points to the following studies to show the preference of the young to listen rather than to read in school: Brown, 1950; Horn, 1937; Russell, 1928; Young, 1936. In fact Rankin (1930) has demonstrated that the greatest amount of time spent by individuals in the communication process is spent in listening. But teachers are often unaware of this tendency; Wilt (1951) showed that teachers underestimated by 50% the amount of time children spent listening.

Auditory skills are pre-requisites for beginning reading (Brown, 1965 and Myklebust, 1967). In fact Hampleman (1958) indicates the same import in the fourth and sixth grades. Devine (1964) reports that reading skills have counterparts in listening.

The auditory skills can be taught effectively. Fawcett (1966) reports that students receiving instruction scored significantly higher on listening tests than students who did not receive instruction. Devine (1964) and Hollow (1955) also found significant gains, Hollow at the .01 level after six weeks of instruction. Pratt (1954) suggests effectiveness of auditory training regardless of the intelligence level. Hollingworth (1966) hypothesized that teacher involvement affected positively the results of training.

Listening ability correlates with many factors. Durrell and Murphy (1953) report that while the child who learns to read easily notices the separate sounds in spoken words, this ability is not assured by a high mental age. Dolch and Bloomster (1937) found a correlation of .4 to .5 between auditory and phonic skills but also noted some failures of children of high mental age to acquire phonic and reading skills.

De Hirsch (1966) stresses the role of auditory abilities in reading. She required pupils to imitate tapped-out patterns of varying difficulty and found that a lack of ability in this area correlated highly with subsequent reading deficiency. A pupil must be able to identify both the temporal sequence and visual/spatial sequence of letters before mastering the phonetic system (1932). Heilman (1957) concurs with this relationship of auditory discrimination and reading. Reger (1968) states that a pre-requisite for reading

acquisition is the previous association with the auditory word.

Ross (1964) expanded his investigation of relationships to include arithmetic, intelligence, personal and social adjustment, socio-economic factors and acuity. Good listeners surpassed poor listeners on all tests and measures except acuity.

Many (1905) studied the relation between the visual mode and the auditory mode of presentation of material. Sixth grade children who were successful in one mode visually were successful in the other. Bateman (1967) found similar evidence with first-graders that to teach to perceptual strengths neither facilitate nor deter the development of word recognition.

Among dyslexics many problem areas are found. The visual and tactile areas have been emphasized. Zigmond (1966) found that deficiencies in the dyslexic population may be specifically related to an auditory impairment.

The above-mentioned findings suggest a number of conclusions:

1. Auditory ability is necessary for total growth, especially academics.
2. Auditory ability can be improved.
3. Improved auditory ability facilitates learning.
4. Auditory training must not be developed in isolation. It must be developed in connection with the total difficulty. Otherwise one might develop a dead-end skill.

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APPENDIX II c

Review of Literature

Intersensory Processing

(Jean S. Morth)

Submitted to
Dr. Blanche Serwer
May, 1970
Jean Shute Morth

The processing of sensory information in man's central nervous system has been described as the functioning of a series of semi-autonomous systems. The input of information occurring in the human organism is processed by individual channels in an autonomous, sensory-specific manner.[1] Zigmond has identified four different kinds of auditory and visual sensory integrations necessary to the process of reading.[2] In addition to these intrasensory processes there are also integrations between auditory and visual modalities. The process of learning to read consists of superimposing a visual symbol, the printed word, on an already established auditory system of communication.[3] This process is the epitome of intersensory functioning.

The so-called intersensory, cross-modal or transducing functions are often subject to breakdown and it has been hypothesized that this disturbance of intersensory functioning is highly related to the acquisition of reading skills. A breakdown in the reading process can be attributed to disorders of auditory intrasensory, disorders of visual intrasensory input, or, as the subject of this paper, disorders of intersensory processes.[4]

1/ H. McGrady and D. Olson, Visual and auditory learning processes in normal children and children with specific learning disabilities, Exceptional children, 36, 8, April, 1970.

2/ Naomi Zigmond, Learning patterns in children with learning disabilities, Seminars in psychiatry, 1, 3, August, 1969.

3/ McGrady and Olson, op. cit.

4/ Zigmond, op. cit.

According to Johnson and Myklebust[5/], certain learning ensues when two or more systems function interrelatedly. If this intersensory learning is impeded, the child may suffer from a severe reading disability. Birch and Belmont [6/] hypothesize that individuals with reading difficulties are disabled because they have nervous systems in which the development of equivalencies between sensory modalities is impaired, while Silver and Hagin[7/] have emphasized techniques directed toward the intrasensory tasks which are prerequisite before the child attempts intermodal tasks or complex verbal learning.

Where perceptual deficits are first trained out, reading instruction at intermodal and verbal levels will be more likely to be successful. Neurophysiological maturation is enhanced through perceptual training and more complex learnings can then take place.[8/]

Indeed, the inability to integrate auditory and visual stimuli appears to have specific significance for the acquisition of skills in learning to read and this inability with intersensory processes is purported to be one of the

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5/ Doris Johnson and H. Myklebust, Learning disabilities: educational principles and practices, Grune & Stratton, New York, 1967.

6/ H. Birch and L. Belmont, Auditory-visual integration, intelligence, and reading ability in school children, Perceptual and motor skills, 20, 1965.

7/ A. Silver and Rosa Hagin, Reading disability: teaching through stimulation of deficit perceptual areas, American journal of orthopsychiatry, 37, 4, July, 1967.

8/ Silver and Hagin, Op. cit.

multiple factors contributing to reading disability.[9] It would be a naive oversimplification to imply that the ability to judge auditory-visual equivalence is the sole factor underlying reading difficulties. However, those individuals who are able to perceive and integrate multi-modal (read intersensory) inputs are more likely to be the better readers.[10]

Birch has outlined the issues in evolutionary perspective.[11] The evolutionary process (phylogeny) has tended to enhance the development of elaborate interconnections; of liaison among and between the existing five senses rather than the development of new sensory modalities. Man differs from animals, not in the acquisition of new, additional senses, but, rather, in his ability to relate the five senses that he possesses through intermodality connections. Geschwind [12] indicates that the region of the angular gyrus in man appears to account for the development of the ability to form complex intermodal associations. Since the evolution of the nervous system has been directed towards development of intersensory liaison, the central nervous system allows for the interaction among the various sensory input avenues. Over long periods of time, interrelationships and interconnections among the various sensory systems and deficiencies

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9/ Birch and Belmont, op. cit.

10/ Birch and Belmont, op. cit.

11/ Birch, Brain damage in children. Baltimore: Williams & Wilkins, 1964

12/ N. Geschwind, Disconnexion syndromes in animals and man. Brain, 1965, 88, 237-294.

of these interrelationships have characterized the phylogenesis as well as the ontogenesis of the human organism.

The interrelationships among senses, in addition to being recently acquired phylogenetically, are also relatively late in developing in the individual (ontogenetically). Since the processes of writing and reading are also relatively new to man's repertoire, it is easy to see why there may be some "bugs" or "kinks" in the system which further evolutionary processes may tend to iron out.

Be that as it may, we must here deal with the conditions as they arise. Although there have been many studies reporting intrasensory perception in children with learning disabilities, by way of contrast, research on intersensory perception is limited. Birch has investigated the integration of information arriving as input from the various sensory modalities. He has indicated that the central nervous system acts as a central clearing house for the sensory modalities bringing the various, separate systems into closer touch with one another. This allows for the higher mental functioning of man and the ability to integrate information.

Birch has investigated the developmental relationships among visual, tactile, haptic, and kinesthetic-proprioceptive systems. Silver and Hagin have also highlighted the developmental nature of the systems in functional interrelationships. A systematic improvement with age in the develop-

ment of intermodality functioning has been noted by these investigators. The investigations of Birch and Belmont have lent empirical evidence for the theoretical position of Geschwind.

Geschwind [13/] has indicated that visual-auditory or cross-modal associations involving vision and audition have become prominent only in man and that there is evidence for an extensive anatomical substrate which can subserve a much larger number of these associations in man. In addition to developing late in the evolutionary process, this inter-sensory functioning also develops late developmentally in the individual.

The ability to acquire speech has as a prerequisite the ability to form cross-modal associations. The ability to acquire skills for reading, also presumes the ability to function cross-modally. Geschwind hypothesizes that it might eventually be possible to predict that the development of reading would be delayed on the basis of failures to learn other cross-modal (visual-auditory) associations such as color-naming. It is highly conceivable that even the age of attainment of color naming might provide the clue to determine the individual's specific age at which reading skills can be acquired most efficiently.

Birch and Belmont studied the child's ability to inter-

13/ N. Geschwind, Neurological foundations of language, In Myklebust (Ed.) Progress in learning disabilities, Volume I, Grune & Stratton, 1968.

relate auditory and visual stimuli by a method of equivalence. The task for the pupil is to identify a visual dot pattern that corresponds to a pattern or rhythm of auditory stimulus. Taps are sounded with half-second pause between short intervals and a one-second pause between long intervals. From three, spatially-presented, visual patterns the subject must select the correct one which corresponds to the temporally presented auditory stimulus. A population of normal and retarded readers chronologically aged nine and ten was used. A comparison was made between the number of correct responses on the auditory-visual pattern test in each of the two groups. A statistically significant difference, at the .001 level of confidence, was noted with the retarded readers obtaining the lower mean number of correct responses.

Birch and Belmont noted a significant relationship between ability to judge auditory-visual equivalence, reading ability and intelligence. The development of visual-kinesthetic organization, particularly in six to eight year-old children, is highly related to the ability to engage in drawing and copying.

Ford [14/] investigated the relation of auditory-visual integration and tactual-visual integration to intelligence and reading achievement. Working with a sample of 121 Caucasian, fourth grade boys, Ford found that auditory-visual integration skills were significantly related to intelligence

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14/ Marguerite Ford, Auditory-visual and tactual-visual integration in relation to reading ability, Perceptual and Motor Skills, 1967, 24, 831-841.

and reading achievement. In addition, it was noted that audio-visual integration processes were significantly related to four specific types of reading errors.

Ford adapted the tactual-visual integrative task (after Buchner, 1964) which tested the pupil's ability to explore tactually a raised geometric figure and then choose the correct form from four visually presented geometric figures exposed successively.

In the auditory-visual task (adapted from Birch and Belmont) Ford tapped out auditory patterns and the subject identified a visual dot pattern which matched the auditory pattern. The visual patterns were exposed successively and the subject viewed the visual pattern only on the original exposure and was required to make a choice without looking back at the earlier-presented patterns. Ford noted that the A-V task significantly correlated with reading achievement at the fourth grade level. Through a qualitative analysis of errors, Ford was able to investigate relationships of intersensory tasks to specific errors in reading.

Zigmond investigated intrasensory and intersensory functioning in dyslexic and normally-achieving readers. The boys in the sample, ranging in age from nine to twelve years, eleven months, were matched in age and intellectual ability. The dyslexic boys were chosen according to the clinical definitions of dyslexis (Myklebust, 1968). Zigmond used nine tests which were specifically chosen to appraise functioning

of processes related to reading skills. Both oral and silent reading measures were used.

Zigmond [15] found that the dyslexics were deficient in all measures of auditory intrasensory and auditory-visual intersensory functioning. However, they performed at a normal level on those measures of visual intrasensory functioning. The auditory-visual equivalents and syllabication measures were significantly correlated with mean reading scores of experimental and control groups.

Since paired associate tasks are analogous to a number of tasks the child is required to perform in the classroom, Zigmond devised four series of paired associate learning tasks. Each series consisted of six stimulus-response pairs which were monosyllabic nonsense syllables (auditory) and/or simple geometric forms (visual). The task had to be learned to a criterion of five out of six correct on two successive trials. Two members of each pair were presented to subjects for five seconds during the first trial. When the stimulus member of the pair was presented alone the subject was asked to reproduce the response member of the pair.

The four series or learning tasks consisted of A-A (auditory nonsense syllable stimulus, spoken nonsense syllable response); V-V (visual geometric design stimulus, geometric design response); V-A (visual geometric design

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15/ Zigmond, op. cit.

stimulus, spoken nonsense-syllable stimulus, drawn geometric design response.) Dyslexics were inferior to controls on Series A-A, and V-A. The A-V series did not quite approach significance. The Series A-A and V-A were significantly correlated with reading ability in the experimental group. These two series were deficient in the reading-deficit group.

McGrady and Olson [16/] have also pointed up the significance of investigating intersensory functioning for the auditory and visual channels in children with reading disorders. An improved method was developed for appraising intersensory perception functioning which might be useful in evaluating and assessing disabilities of pupils. In their study, a test battery was administered measuring a variety of intra and intersensory learning functions. The population for this study contained subgroups of eight and nine year old children in a control group and a learning disability group. A large group of control subjects was used in an effort to establish normative data on the psychosensory processes tested in this study.

The learning disability population was selected from a clinic population at Northwestern University; the controls were selected from a group of normal children participating in the Northwestern University Public Health Services learning disability study.

16/ H. McGrady and D. Olson, Visual and auditory processes in normal children and children with specific learning disabilities, Exceptional Child, 36, 8, April 1970.

The controls were comparable to the learning-disabled group on such factors as age, grade, sex, and socioeconomic factors. The I.Q. criterion of 90 or better on either the Verbal or the Performance Scale of the WISC was used. The formula for the Learning Quotient (Myklebust, 1968) was used to determine the existence of a deficiency in an academic skill.[17/]

All tests were presented and recorded by the psychosensory communications unit. The auditory stimuli were presented through headphones; the task required the subject to decide if two stimuli were the same or different.

The visual task required the subject to select the one picture out of three presented which is identical to the original stimulus. Another type of visual task was for the child to indicate whether two pictures presented were alike or different. The intersensory tasks were of either type.

The psychosensory unit recorded the time of response for each stimulus presentation in tenths of a second. In this way the latency of pupil's responses could be analyzed.

The eight-year-old learning disabled pupils had difficulty in all tests in which visual symbols were presented. When the task was auditory, they performed adequately. The nine-year-old learning disabled pupils performed with more errors than the normal controls on all tests utilizing sym-

17/ Myklebust, op. cit.

bols presented in auditory, visual, auditory-visual or visual-auditory intersensory tasks.

Differences were also noted between the normal and learning disabled pupils when time of response was analyzed. The eight-year-old pupils with learning disabilities had more difficulty on psychosensory functions according to the response time criterion. The learning disability group performed more slowly than the normal controls. On nine out of thirteen tests this difference proved to be statistically significant.

Although the eight-year-olds performed as well as the normal controls in terms of number of errors on all nonverbal subtests, they were slower to respond. McGrady and Olson noted that the thought processes for making decisions seemed to be lengthier with learning disabled children even though they may perform correctly.

The deficiencies in response time for the learning disability group were noted in every intrasensory and intersensory task.

The pupils with learning disabilities evidenced problems in comprehension of language rather than perceptual or nonverbal stimuli. The tasks involving verbal stimuli were more difficult for the learning disabled.

APPENDIX III

The Wellesley Rating Scale

a structured teacher-questionnaire.

SCREENING CRITERIA

Children of normal or superior intelligence with multiple and severe learning disabilities are expected to have three or more of the following possible symptoms:

1. Clumsiness, difficulty in gross motor coordination
2. Hyperactivity, excessive restlessness, difficulty in attention and concentration
3. Difficulty in space perception and in understanding language pertaining to positions in space
4. Difficulties in speech, such as delayed language development, defective articulation of speech sounds, cluttering or stuttering
5. Difficulties in the use of language, such as difficulties in word finding, in sentence building, and in the organization of thoughts and ideas
6. Difficulties in rhythm, manifest in disability in skipping, hopping, following a musical sequence; distortion of speech rhythm and speech melody
7. Difficulty in fine motor coordination, holding a pencil, drawing, writing
8. Difficulty in the learning of visual symbols, reading, writing, spelling
9. Difficulty in the understanding and the use of numerical concepts (arithmetic)
10. Marked difficulty in working constructively with their peers.

APPENDIX IV

Letter Names Pre-Test

(after Durrell)

EXPERIMENTAL MODEL SCHOOL PROGRAM FOR CHILDREN
WITH LEARNING DISABILITIES - 1970

Waltham Reading Department

LETTER NAME TEST

Name _____ Gr. ____ Teacher _____

School _____ Date _____

Test # 1

O X A B T C L R U V
I S P N F E H D
M K Z J Y W G Q

o x s q i p t m
k z e w r j y f
n a h v u b d l g o c

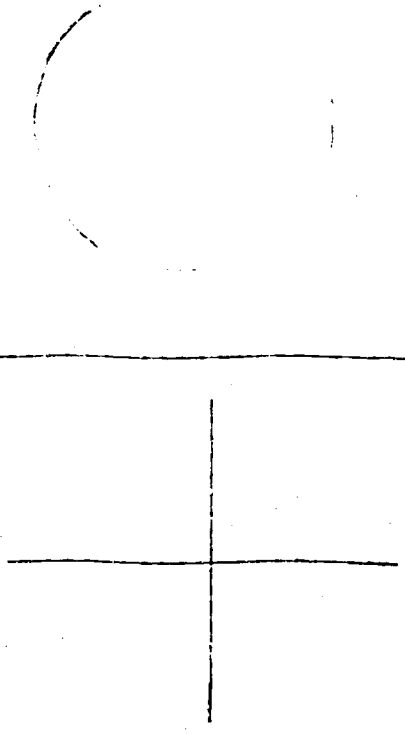
Steps: 1. Flip Durrell letter cards in front of child
2. Circle letters incorrectly pronounced. Mark type of error if possible

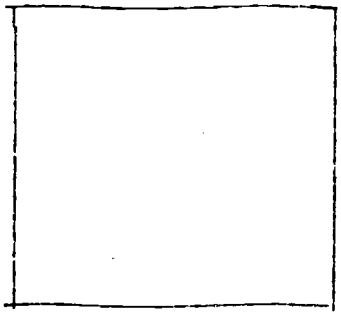
APPENDIX V

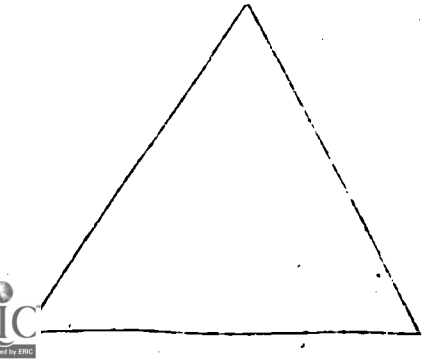
Early Detection Inventory:

Geometric Figures

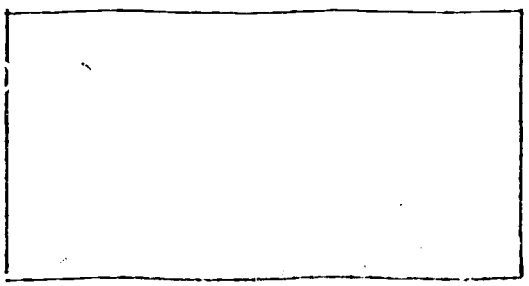
GEOMETRIC FIGURES

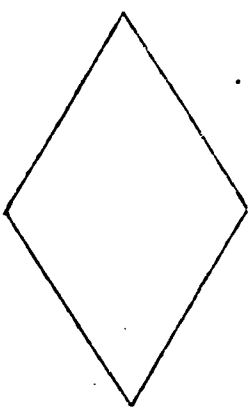


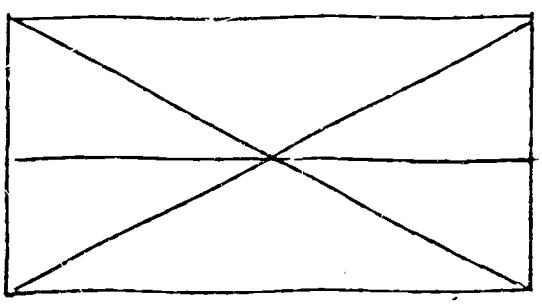




GEOMETRIC FIGURES (Continued)







APPENDIX VI

Screening Inventory: Waltham S.L.D. Project

Part 1. Educational, Cognitive Dimensions

Part 2. Environmental, Home Personal Dimensions

SCREENING INVENTORY

Specific Learning Disability Project

Name of Pupil: _____ _____ _____
(Last) (First) (Middle)

Sex: _____ Birth Date: _____

Parents' Names _____

Address _____ Telephone: _____

School: _____ Teacher: _____ Date: ____

Indicated Dificulties: Hearing ____ Sight ____ Speech _____

Other Physical _____

OVERALL RATING

	1	2	3
Perception			
Cognition			
Spatial and Temporal Orientation			
Social-Emotional Behavior			

PERCEPTION

Check appropriate items and column:	1 GOOD	2 FAIR	3 POOR
1. Auditory discrimination listen to story; follow			
2. Visual discrimination			
3. Kinesthesis			
Gross motor coordination			
a. Walking without stumbling into things			
b. Catching or throwing a ball			
c. Running in a coordinated way			
d. Hopping in a coordinated way			
e. Skipping in a coordinated way			
f. Walking a straight line			
g. Balancing (on a balance beam)			
Fine motor coordination			
a. Position or grip on pencil or crayon			
b. Ability to color smoothly within boundaries			
c. Manipulation of paintbrush and paint			
d. Tying of shoelaces			
e. Cutting and pasting			
f. Competency in writing: letters			
own name			
numbers			
Sense of rhythm			
a. Tapping out a song			
b. Marching or dancing to music			
c. Success in a rhythm band			
d. Ability to recognize or imitate simple rhythmic patterns			
4. Inter-modality transfer or coordination			
Visual-motor coordination			
a. Ability to copy correctly from: near point			
far point			
*b. Reproduction of geometric figures			
Visual-Auditory			
a. Ability to make sound-symbol correspondence			

KEY:
1. If checks are concentrated in Column 1
2. If checks are scattered
3. If checks are concentrated in Column 3

PERCEPTION RATING

* attached page of geometric figures

COGNITION

Check appropriate items and column	1 GOOD	2 FAIR	3 POOR
1. Teacher's estimate of child's intelligence			
2. Teacher's estimate of child's reading ability (If child has already started to read)			
3. Information			
a. Knowledge of own name			
b. Knowledge of address			
c. Knowledge of telephone number			
d. Knowledge of birthday			
e. Knowledge of age			
f. Knowledge of number concepts			
g. Knowledge of colors			
h. Progress in letter-naming			
4. Conceptual development			
a. Ability to follow oral directions			
b. Interpretation of pictures			
c. Solution of simple puzzles			
d. Ability to formulate ideas from isolated facts			
e. Ability to categorize (produce class names for groups of words)			
f. Judgement of relationships (big-little; big-bigger-biggest; far-close)			
5. Expressive language			
a. Comprehension and command of vocabulary			
b. Correct usage of syntax			
c. Ability to construct meaningful sentences			
d. Organization of thoughts and ideas			
e. Appropriate and "on the track" contributions to class discussions			
f. Ability to give complete responses to questions			
g. Memory: - ability to recall information			
- ability to recall experiences			
- ability to repeat short rhymes			
- reconstruction of a story keeping events in order			

KEY:
1. If checks are concentrated in Column 1
2. If checks are scattered
3. If checks are concentrated in Column 3

COGNITION RATING _____

SPEECH

Check any of the following defects the child may exhibit:

____ baby talk

____ inability to make certain sounds

____ indistinct enunciation

____ lisping

____ stammering

____ stuttering

____ cluttering

____ omitting or adding sounds

____ Mixing up the order of sounds: "aminal"

____ halting speech

____ distortion of speech rhythm and melody

SPATIAL AND TEMPORAL ORIENTATION

Check appropriate items and column:	1 GOOD	2 FAIR	3 POOR
1. Knowledge of directions (left-right; over-under; in-out; up-down; top-bottom; beginning-end)			
2. Knowledge of days of the week			
3. Knowledge of the seasons			
4. Concept of time - "being on time"			
5. Recounting of a story in order			
6. Following directions requiring spacial orientation ("Turn left")			
7. Lateral Dominance			
a. Handedness ____ right			
____ left			
____ poorly defined			
b. Eyedness ____ right			
____ left			
____ poorly defined			
c. Footedness ____ right			
____ left			
____ poorly defined			

KEY:
1. If checks are concentrated in Column 1
2. If checks are scattered
3. If checks are concentrated in Column 3

SPATIAL AND TEMPORAL ORIENTATION RATING: ____

SOCIAL-EMOTIONAL BEHAVIOR

Check appropriate column:	1 EXHIBITS TO A MINOR DEGREE	2 EXHIBITS TO A MODERATE DEGREE	3 EXHIBITS TO A MAJOR DEGREE
1. Behavioral characteristics			
a. Hyperactive and restless			
b. Lethargic			
c. Daydreaming alternating with hyperactivity			
d. Inconsistent achievement			
e. Explosive and unpredictable behavior			
f. Upset by changes in routine			
g. Confused, indecisive, or apprehensive in responding			
h. Confused by punishment			
i. Lacking in self-control (will speak out or jump out of seat)			
2. Social Relationships			
a. Inclined to work alone - withdraws quickly from group activities			
b. Aggressive and destructive, especially of work of others			
c. Disruptive of group activities			
d. Lacking in cooperation			
3. Poor acceptance of responsibility			
4. Attention			
a. Cannot concentrate on a given academic or social task for a reasonable length of time			
b. Does not listen attentively			
c. Says "What?" when he receives instructions (because of insecurity)			
d. Gives inappropriate answers to questions			
e. Needs constant supervision to complete an assignment			
f. Lacks perseverence on a given task			
5. Emotional Development and Control			
a. Stability			
(1) Crying			
(2) Fear			
(3) Temper			

SOCIAL-EMOTIONAL BEHAVIOR (2)

Check appropriate column:	1 EXHIBITS TO A MINOR DEGREE	2 EXHIBITS TO A MODERATE DEGREE	3 EXHIBITS TO A MAJOR DEGREE
(4) Excitability			
(5) Exhibitionism			
(6) Sensitivity			
(7) Insecurity			
b. Self-Reliance			
(1) Confusion			
(2) Dependence			
(3) Discouragement			
(4) Lack of confidence			
c. Reality-testing - tells bizarre stories			

KEY:		
	1. If checks are concentrated in Column 1 2. If checks are scattered 3. If checks are concentrated in Column 3	SOCIAL-EMOTIONAL RATING

PARENTS AND THE HOME

A. Marital Status

1. Does child reside with:
   ____ both parents
   ____ mother
   ____ father
   ____ others (explain)

2. Is home situation:
   ____ good
   ____ average
   ____ abnormal (explain)

B. Economic Status

1. Father's occupation _____
2. Mother's occupation _____
3. Is economic status superior?____ average?____ poor?____

C. Siblings

1. _____ is the _____ of _____ siblings.
2. Specify any siblings exhibiting learning difficulties:
   _____
   _____
   _____

D. Neighborhood

1. Is neighborhood superior?____ average?____ poor?_____
2. Are playmates: his age?_____ older?_____ younger?_____
3. What type of house does the child live in? _____

E. Parental cooperation

1. Does parent send the child to school regularly?_____
2. Are parents: overprotective?_____ overindulgent?___
   neglectful? _____
3. Is child sent to school clean and well kept? _____

ANECDOTAL RECORD: Record any unusual circumstances, happenings, achievements or personality traits not covered above.

INTERESTS

Check degree of interest in:	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE
1. Books			
2. Building things			
3. Drawing			
4. Music			
5. Science			
6. Painting			
7. Pictures			
8. Individual play			
9. Informal group play			
10. Organized group play			
11. Dramatizing stories			
12. Stories told			
13. Stories read			
14. Telling stories himself			

HEALTH

A. History

1. Were pregnancy and delivery normal? _____
2. Indicate any surgical treatment: _____
3. Indicate any chronic health disability: _____
4. Indicate any physical deformity: _____
5. Does child exhibit any auditory difficulty? _____
6. Does child exhibit any visual difficulty? _____
7. Is condition of teeth good?____ fair?____ poor? _____
8. Is the child under regular dental care: _____
9. Check illnesses child has had:

____ bronchial trouble	____ middle ear infection
____ chicken pox	____ mumps
____ chorea	____ nephritis
____ convulsions	____ pneumonia
____ diphtheria	____ rheumatism
____ eczema	____ scarlet fever
____ heart trouble	____ tonsilitis
____ influenza	____ whooping cough
____ mastoid	_____ (other)
____ measles	_____ (other)

B. Habits

1. Does he have a daily nap? _____
2. Does he brush his teeth regularly? _____
3. Does he tire easily? _____
4. What is his bedtime? _____

5. Check any habits he exhibits:

____ bad eating habits	____ nervous vomiting
____ bed wetting	____ night terrors
____ emotional tantrums	____ nose picking
____ frequent urination	____ sleep talking
____ masturbation	____ sleep walking
____ nail biting	____ thumb sucking
____ nervous twitches	____ (other)

C. Check any of the following organic speech defects the child exhibits:

____ cleft palate

____ dental malformation

____ hare lip

____ tongue-tied

____ paralysis of tongue

D. Optometrist's Evaluation:

_____

_____

_____

_____

_____

E. Size and Appearance

As compared with others in the group he is:

____ Obese	____ Average	____ Thin
____ Tall	____ Average	____ Short
____ Sturdy	____ Average	____ Weak
____ Ruddy	____ Average	____ Pale
____ Mature	____ Average	____ Immature

APPENDIX VII

Interim Post Testing

1. Roswell Chall Auditory Blending Test

2. Oral Word and Letter Names Test

EXPERIMENTAL MODEL SCHOOL PROGRAM FOR CHILDREN
WITH LEARNING DISABILITIES - 1970

Roswell Chall Auditory Blending Test

SAMPLE WORDS: s - ing. t - op, s - i - t

Part I

1. a - t ____
2. n - o ____
3. i - f ____
4. u - p ____
5. s - ay ____
6. m - y ____
7. b - e ____
8. t - oo ____
9. c - ow ____
10. h - e ____

Number Correct
Part I _____

Part II

11. at - ep ____
12. f - at ____
13. pl - ay ____
14. b - oat ____
15. ch - ain ____
16. b - ed ____
17. c - ake ____
18. r - an ____
19. t - ime ____
20. c - all ____

Number Correct
Part II _____

Part III

21. c - e - t ____
22. b - i - g ____
23. c - u - ff ____
24. s - a - d ____
25. g - o - t ____
26. m - a - p ____
27. r - u - g ____
28. d - e - sk ____
29. t - oa - st ____
30. p - e - t ____

Number Correct
Part III _____

Total Raw Score _____
(total number correct for Part I + II + III

Comments _____

_____

Adequate Blending ☐

Inadequate Blending
(check one) ☐

EXPERIMENTAL MODEL SCHOOL PROGRAM FOR CHILDREN
WITH LEARNING DISABILITIES - 1970

WALTHAM PUBLIC SCHOOLS

ORAL WORD AND LETTER NAMES TEST — DECEMBER, 1969

Bill	will	O	E	o	j
Lad	not	N	H	x	y
run	a	A	D	s	f
stop	Nan	B	M	c	n
we	get	T	K	i	a
Jill	and	C	Z	p	h
rides	look	L	J	t	v
can	help	R	Y	m	u
at	is	I	W	k	b
hides	park	S	G	z	d
said	no	P	Q	e	l
Ben	this	M	U	w	g
here	duck	F	V	r	q
Ted	yes				

Score ____ Score____ Score____ Score____ Score ___ Score___

Total____ Total____ Total____

October Total ____ October Total___

Words from Ginn "360" Edition

Waltham Motor Tasks

Carol Wadell
Tina Federico

1. Gross Motor Skills

Basic locomotor skills - hop, skip, jump, slide, gallop, leap, run and walk were tested. All were executed in all directions when applicable (forward-backward-sideward).

Rating: Judgment of examiner

2. Fine Motor Skills

Finger thumb opposition
Observation of pencil grip while writing name
Independent finger mobility (typewriter imitation)

Rating: Judgment of examiner

3. Sense of Rhythm

Ability to march to music. (March played on a tape recorder)

Rating: Judgment of examiner

4. Balance: Stationary

Ability to balance on each foot independently. Score recorded for dominant foot. Any large discrepancy between dominant and non-dominant foot should be noted.

Rating:
1. 0-9 seconds
2. 10-14 seconds
3. 15-24 seconds
4. 25-34 seconds
5. 35 plus

5. Balance: Locomotor

Observation by examiner during testing for gross motor skills. Movement in all directions is considered.

Rating: Judgment of examiner

6. Knowledge of Direction

Directions used:

Up	Forward
Down	Backward
Over	Sideward
Under	Around
Toward	Away From

Right and left of self
Right and left of others

The student was asked to move in the directional planes of forward, backward and sideward. He was asked to show how he would go under and over a desk, and to place his hand under and over a pencil held by the examiner. He was asked to point up and down.

Right and left directions of self were tested by asking him to: 1. show each hand, touch left ear, right knee, etc. 2. Touch opposite sides -- left hand to right ear, etc. 3. The right and left hand of the examiner - while facing the examiner

Rating:

1. Three or more directions incorrect. (not including right and left)
2. One or two directions missed. (not including right and left)
3. All directions correct with the exception of right and left.
4. All directions including right and left of self correct.
5. All directions, right and left of self and right and left of others correct.

7. Body Awareness

Identification of body parts only.

Rating:
1. Confusion with such parts as arm, leg, etc.
2. More than two joints missed or confused. (elbow, knee, etc.)
3. Confusion or inability to name one or two joints such as elbow, ankle, wrist, etc.
4. All parts correct with some hesitation.
5. All parts correct with no hesitation.

8. Hand-Eye Coordination:

Catching of objects (bean bags) thrown in all planes - high, low, toward the midline, away from midline, etc.

Touching a moving object, such as a pencil held by the examiner or the examiners finger. The object was held within arms length of the student and moved in all planes.

9. Midline Transfer:

   a. Ability to cross body with arm: left arm to right knee, etc.
   b. Hop alternately on each foot - with ease of transfer
   c. Draw a circle on the chalk board, crossing midlines with ease: horizontal as well as vertical

   Rating: Judgment of examiner

10. Dominance:

   Hand: writing, reaching, throwing, combing hair and brushing teeth

   Eye: Monocular: Sighting through telescope
   Binocular: Cone test from Harris Laterality (Key only)

   Foot: Stamping on floor, hopping on one foot, kicking, balance on one foot.

   Extension test: both arms are placed straight out in front of the student at shoulder height. Eyes are closed. Arm which remains elevated is noted. (Key testing only)

EXPERIMENTAL MODEL SCHOOL PROGRAM FOR CHILDREN
WITH LEARNING DISABILITIES - 1970

MOTOR EVALUATION

NAME: _____

	October Testing 1969					December Test 1969				
	1	2	3	4	5	1	2	3	4	5
1. Gross Motor Coordination										
2. Fine Motor Coordination										
3. Sense of Rhythm										
4. Balance: Stationary										
5. Balance: Locomotor										
6. Knowledge of Direction										
7. Body Awareness										
8. Hand-Eye Coordination										
9. Midline Transfer										

10. Dominance:

Hand:	_____	_____
Eye:	_____	_____
Foot:	_____	_____

KEY:
1. Poor
2. Fair
3. Average
4. Good
5. Very Good

APPENDIX IX a

Strategies for Remediation of Auditory Problems

Auditory Discrimination

Auditory Sequencing and Auditory Memory

Auditory Analysis and Synthesis

WALTHAM S.I.D. PROJECT

Strategies for Remediation of Auditory Problems

I. Auditory Discrimination

A. Identification of specific sounds from a recording. Examples: bell, fire engine, boat whistle, etc.

B. Comparison of sounds: a button and a penny are shown. One is dropped. Child must tell or point to the one he heard drop after it has been replaced.

C. Bell ringing: using soft tone bells, let the child decide which one the teacher has rung. (Child has been introduced to each bell tone prior to testing.)

D. Using an empty, a half full and a full glass, have the child (with eyes occluded during the operation) tell which glass the teacher has tapped.

E. Sound tubes: blow through tubes of different lengths, diameters, materials. Have the child close his eyes and identify the tube used.

F. Which word doesn't rhyme? <u>pat</u>, <u>rat</u>, <u>pan</u>

G. Are these sentences the same or are they different?

I have a tin fan I have a tin pan.

H. Students using visual response cards, hold up the appropriate card to match sound teacher makes:

/b/ /d/ /p/
/f/ /v/ /th/

I. Exercises in discrimination of critical auditory pairs in areas needed:

placement:	pan - pen
voicing:	cap - cab
high frequency loss:	fine - sign
late development:	clove - cloths
English as 2nd lang.:	then - den

J. Record familiar sounds. Child tells which sound is what. (car, airplane)

K. With eyes closed the child must locate the same sound or different sounds (bell, chair scraping, etc.) in different locations.

L. Using a classroom hand-bell, the instructor taps out a model pattern, followed by 2 or 3 patterns containing the model pattern. The child must pick out the model pattern.

M. Given a sample word, the child must pick out the same word placed among two or more words which are similar. e.g., saw; was saw paw jaw.

N. Story is read to child containing words which sound like words that should be there. He stops you when you say "incorrect" word and he supplies the correct one.

O. One pupil drops marbles into jar, bounces ball, claps, etc., a certain number of times. Second child reports number and type of activity. Second child is blindfolded.

P. Using a cylindrical mailing tube or similar device, hold one end to child's ear as he winds a string upon a spool. The moment the teacher stops making the sound, he must stop winding.

Q. Group of children close their eyes. Tap one child to go to back of the room. Have him say some little phrase or a few words and see if the children can guess who the mystery voice is.

R. Montessori recommends eliminating, as far as possible, all sounds from the environment. The aim is to have children notice slight sounds, which are unnoticed, i.e., ticking of the clock, chirping of birds. The "lesson of silence" ends with a calling of children's names. Call is made in a whisper, that is without vocal sound. This demands a close attention on the part of the child, if he is to hear his name.

S. Ability to discriminate between high and low pitches should be developed. Teacher may play two notes on the piano and ask, "Which was the high note?"

T. Listen to sounds on tape and choose picture that goes with sound.

U. Identify the vowel or vowel sound within a word. Work with listening to differences between: shall - shell; cup - cap; hot - hut

V. When child can distinguish similarities and words by matching them, make the task more complex by having him reauditorize the sound (say it to himself.) "This time I want you to listen for the n but try to remember it without saying it aloud. I will say some other sounds and when I say n (the one you are thinking of) raise your hand."

II. Auditory Sequencing and Auditory Memory

A. Clap patterns: teacher claps a pattern and the child repeats it.

B. Children sit on floor in a circle with the bell in the center. Teacher gives a direction and calls on a child to carry it out "Walk to the bell, walk around it and then ring the bell three times."

C. Teacher pronounces a series of digits or words. Pupil repeats them after intervals varying from one to sixty seconds. Child can give himself his own series, wait the prescribed interval, and then repeat series.

D. Tap out a simple rhythm on the table. Give the child a crayon and have him repeat your rhythm. Reverse the procedure. Let him test you and see if he can listen and recognize your mistakes. (Use various other objects for tapping patterns such as piano, drum, xylophone, etc.)

E. Use rhymes and songs, stories and plays (dramatic dialogue) for the child to learn and repeat back.

F. Recall of telephone numbers, addresses, names of children in classroom, etc.

G. Play a tape or record of music or sounds. Children listen with heads down, then tell what was heard.

H. Child repeats vocally a series of numbers or words recited to him.

I. A three or more event story is recited for the child. The pupil must repeat the events, preferably in correct sequence.

J. Use Language Master for memory and sequencing. Child becomes aware of and corrects his own errors.

K. Give pupil a piece of paper and have him fold it into four squares. Read aloud four sentences and have him draw a picture suggesting the word or phrase you will repeat after reading the sentence. i.e., "John was like a scared mouse in a lion's cage."

L. Draw a circle on the blackboard, then clap once to indicate that one figure represents one sound. Next draw two circles and clap twice. Follow with three and then four. Ask pupil to look at each series of figures and clap the correct number of times for each set. Stand behind him and clap a certain number of times; ask him to point to the set of figures corresponding to the number of sounds he heard.

M. Select pictures or a series of objects that are used together and place them before the child. (stove, sink, refrigerator, pencil, pen, paper, hat, coat, gloves). Say the words for him and ask him to repeat the names while simultaneously looking at the pictures. Then remove the pictures and ask him to say the series.

N. Arrange play situations; older children enjoy playing restaurant and ordering the items from the menu. Have pupils use clues which stimulate recall. Some write the first letter of each word; others need only to indicate the number of things they are to remember. Some pupils will repeat each word several times in order to memorize it.

O. Exercises are prepared for the tape recorder which can be used for independent work. Sheets of pictures are given each child and he listens for directions, such as, "I will say the names of some things on your paper. You are to listen and mark the ones I say. Mark the apple, the orange, and the grapes...."

III. Auditory Analysis and Synthesis

a. Provide child with a check list of letters. Have him circle those he hears at the beginning or the end of words.

b. Have child identify pictures of objects with names that rhyme. No audible clues are given.

c. Give child an incomplete sentence and have him supply the missing word orally. Increase syntactical complexity of the sentences as ability increases.

d. Given a sample sound (car sound), the child must raise his hand whenever the sound occurs in a composite, such as a recording of street sounds.

e. Given a sample verbal sound (letter sound, word, or phrase) the child must raise his hand whenever he perceives the sound in a composite (in a series of letters, a sentence, etc.)

f. Child is given three cards of different colors marked 1, 2, and 3 respectively. Depending upon where he hears the sample sound, at the beginning (card 1), middle (card 2), or the end (card 3) he raises the proper card.

g. Speech-to-Print exercises (Durrell-Murphy).

APPENDIX IX b

Strategies for Remediation of Visual Problems

Visual Discrimination

Visual Memory and Sequencing

Visual Analysis and Synthesis

16. Individual letters can be introduced by using sand paper or clay; use tracing stencils and trace or write letters.

17. Bryant, in "Some Principles of Remedial Instruction for Dyslexia," recommends giving the subject a word with parts missing. Subject must notice missing details.

18. Objects and pictures can be matched to outline drawings.

19. Fairbanks-Robinson Program 1 Level 1, Perceptual Motor Development, has two sections which can be helpful in improving visual discrimination. Section B, form recognition and discrimination has six basic shapes and many similar unrelated shapes, which child must discriminate. Section C is concerned with figure/ ground relationships.

II. Visual Memory and Sequencing

1. A simple tachistoscope for use with the overhead projector can be made. It consists of a transparency to which is attached a sliding window just large enough to expose a single letter of a word, or a single word at a time in left-right sequence.

2. Arrange colored beads on a string according to a specific pattern; child continues the pattern.

3. Place group of objects on a table. Cover the objects and ask children to name what they saw.

4. Place a series of numbers in front of child; take them away and tell child to place numbers in sequence as he had seen you do it. (Similar to ITPA sub-test).

5. Show child a sentence and give him time to read it to himself. Remove sentence from view and see if he can repeat it.

6. Place a selection of objects in front of child. Remove one and ask him what is missing.

7. Make a pattern of pegs on a pegboard. Ask child to make a similar pattern.

8. Ask child to close his eyes and describe his clothing, or something he has seen such as the bulletin board, etc. (Immediate verbal recall.)

9. Place picture cards in a sequence. Make a note of the sequence to avoid controversy; shuffle the cards and have child recreate the sequence.

10. Have the child match a certain pattern of shapes with a similar pattern among a series of choices. The initial stimulus could be covered after the child has had a chance to see it.

11. Child picks out increasingly longer series of letters or numbers. Letters and numbers are not in any patterns.

b c p d a d b p c b p d b c p d

12. To develop long-term memory, child is presented with a visual stimulus of words or phrases learned previously. Remove the stimulus; the pupil must pick out the word or phrase from a story prepared prior to the lesson.

13. Place several objects on the table behind the child. Tell him to turn to look at the objects for a few seconds, then turn away and name as many of the objects as he can remember. (Increase the number of objects as he meets success.)

14. Expose a picture of many familiar objects. Cover it and have pupil tell as many things as he can remember.

15. Have pupil assemble selected comic strips in proper order from a remembered model.

16. Have child copy a pattern with string (from memory) on dark construction paper.

17. Present a design or pattern to child. Remove the model and represent it with changes. Have child indicate the changes you have made.

18. Bryant in "Some Principles of Remedial Instruction for Dyslexia" recommends the usefulness of writing and tracing words to increase visual memory.

19. A red indicator light and a wooden panel with a telegraph key similar to that used by Rosenbusch and Garner to study developmental patterns in visual and auditory rhythm perception could be used to increase visual sequencing and memory. Subject tries to reproduce the visual stimulus pattern by pressing the telegraph key.

20. Dubnoff School Program with its directional-spatial pattern board exercises could be used. Subject is shown an exercise pattern card and asked to reproduce the pattern with colored rubber bands.

21. Perceptual cards and dominoes games of the Eric Program I might be helpful in increasing the child's visual memory and sequencing ability.

22. Manual for the Beery Buktenica Test of Visual Motor Integration has some suggestions for remedial activities.

III. Visual Analysis and Synthesis

1. Have pupil finger trace objects in the foreground and background of photograph.

2. Child cuts out specific objects from pictures.

3. Ask child to point out specific objects in the foreground or background of pictures.

4. Cut up photographs or pictures as in jigsaw puzzles and let child reassemble them.

5. Conceal pictures or geometric forms with extraneous lines; let pupil find the picture.

6. Use Highlights Magazine: "Find the missing object."

7. Show how abstract designs are made up of parts; show how geometrical forms can be put together to make shapes.

8. Use Kohs blocks for making forms.

9. Frostig exercises: figure/ground and spatial relationships.

10. Pupil is given three boxes arranged from left to right as follows:

    a. contains beginning parts of words
    b. contains vowels
    c. contains ending parts of words

    He draws a card from each box in turn, arranging the cards in proper sequence and pronouncing the part he chose. He must then pronounce the word. If a nonsense word appears, child may be able to change it in one step to a real word.

11. Have pupil choose the similar form that has one factor in common with the stimulus.

12. Match column A with the whole word in Column B

A	B
re mem ber	remainder
pro tec tion	remember
re main der	protection

13. Have child do exercises in "Follow the dot" books.

14. Present puzzles of three dimensional geometric figures composed of smaller units to be taken apart and put together again. (commercially available.)

15. Offer hidden figure puzzles such as those found in comic section of Sunday newspaper. These can be successfully thermofaxed to provide multiple copies if desired.

16. Parquetry sets and blocks are useful.

17. Accent or syllabication can be indicated visually.

    e FORM i ty dis con TIN ue

18. Show pupil a complex design. Tell him to pick out a particular shape.

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APPENDIX IX c

Strategies for Remediation of Fine Motor Problems

Strategies for Remediation of Fine Motor Problems

1. Trace from large geometric objects. Have child cut out object he traced.

2. Have child fit cut out forms into same size spaces.

3. Castinettes can be used to develop auditory sequencing while using and controlling hand movements.

4. Use acoustic tiles as "marbleboards." Place marbles on holes to form letters or words. Color coding may be used. Guidelines may be indicated by teacher with masking tape.

5. Begin with simple paper folding activities; with more able pupils extend to origami.

6. Activities such as coloring, cutting and pasting, tracing, dot to dot pictures.

7. ETA dressing frames: individual forms for buttoning, zipping, snapping and buckling.

8. Use kitchen tongs to pick up and deposit, in a designated place, objects of varying size and shape; tweezers can be used later.

9. Provide simple cut-out dot pattern and bright colored yarn. Pupil threads the yarn through holes following pattern.

10. Activities from arts and crafts develop fine motor coordination: finger-painting, knitting, and jewelry making.

11. A slot box with a hole for spools on the top, a slot for string on one side, a triangle on the other can be used to develop manual dexterity. Child puts string, spools, and triangles in correct slot.

12. A bolt and nut board 10" x 12" x 1" can be made by boring holes in a piece of wood. Child inserts a bolt through the hole and screws the appropriate nut on it.

13. Learning to tie, button, lace and zipper as well as untying knots (first in curtain cord, then in wrapping string and yarn) are all helpful for developing fine motor control.

14. Puzzles, pegboards, pounding boards, hammer and nails, tracing, cutting, coloring, and tearing are part of fine motor coordination recommended by Kirk and Johnson.

15. Activities such as weaving, sewing bean-bags, stitchery, mosaics using seeds, beans, macaroni, pebbles, etc; toothpick or straw shapes and sculpture; lacing; stringing beads; drawing maps.

APPENDIX IX d

Strategies to Improve Cognitive Skills

Strategies to Improve Cognitive Skills

1. Work with a box of assorted objects; ask child to tell you what each object is, then tell or show as many ways that he can, how it is used.

2. Make up analogies of different types for children to solve. Be sure child understands the relationship involved (sequencing, part of whole, composition, action, etc.)

3. Make charts divided into two parts. On each part put different amounts of objects or numbers. Child points to side with more or less. Using chart with three parts, use similar pictures having child indicate more, most. least, etc.

4. Classification: Pupils answer question, "If you had one of three wishes, would it be for fame, fortune, or for wisdom? Distribute cards, each of which has a sentence telling what some child would like to do (e.g., Susie wants to be on a quiz show.) Child who receives card decides which category it correlates with best.

5. Association: Give child a dozen or so objects. He groups them according to use. If he has difficulty, indicate one object and have him find others which could be used in a similar way or for a related purpose.

6. Identification: show child object or picture of one. Ask him to explain how it may be used or what it may be used for.

7. Analysis: Take an imaginary or real trip through a grocery store. Discern the logic behind the arrangement of items. What items are placed together? Have child describe how he would proceed to set up his own store or shop.

8. Analysis: Consider a room in a home. What items would you expect to find in that room. (example: kitchen)

9. Analyze the various type faces used in newspapers/magazines.

10. Synthesis: for spatial organization practice fitting boxes of various sizes into a larger box or bag.

11. Sort items such as nails, screws, etc., according to size.

12. Sort dried beans according to type (lentils, kidney, navy, etc.)

13. Use attribute blocks for abstract classification.

14. Use pictorial and verbal absurdities: child points out incongruities.

15. Forming relationships---which of several specific items belong together?

16. Making judgements in size; in weight: which of two pictured objects is larger in reality?

17. Making associations such as: Snow is white, grass is _____.

18. Understanding causal relationships.

19. Sequence of ideas: A picture story is cut in parts and pasted on cardboard. The leader mixes the cut-up pieces and passes them to the group members. The child who thinks he has the first part of the story tells about it. The others follow suit. Pictures are then arranged on the chalkboard tray in proper sequence.

20. Which one doesn't belong? Name a group of four things. Have child explain why one doesn't belong.

21. Have the child name as many things as he can which belong in one category. (Example: foods, colors, animals, etc.)

22. Exercises in which children must select a word to go with a series of given words are useful for practice in classifying ideas.

    Example: July, May, _____ spring March Saturday

23. Provide a list of words on the board; each child reads the words and arranges them in categories which you specify.

    Words: blue horse red stone chair stool

    Categories: Animals Colors Furniture

24. Make a comparison chart such as the following:

    The Beaver and the Groundhog

    List and compare the traits of the animals such as: food, habits, means of protection, size, hibernation, kinds of homes, appearance.

25. Summarize the main ideas of a story in sequence.

26. Retell in sequential order events selected from content subjects. In relation to science: Stages in the growth of a given plant, the nine planets of the solar system according to their distance from the sun, the stages of the evolution of the earth.

APPENDIX IX

Strategies to Improve Intermodality Transfer

Auditory-Visual

Visual-Motor

Strategies to Improve Intermodality Transfer

Auditory-Visual

1. Assuming the child understands a high sound is "up" and a low sound is "down", measures of music can be played and the child can pick out the drawn staff showing the notes that were played.

2. Use taped sentences and pictures to work with auditory visual associations. Child hears a sentence and picks the picture that goes with it. When child can read, the taped sentences and dittoes with the sentence varying in some way are used. The child hears the taped sentence and finds the written one on the sheet that is just like it.

3. The teacher says letter sound (blend or digraph sound) and the pupil chooses the letters on a chart.

4. Teacher taps out letters on something like a piano or a code key (that will sustain a sound) using the Morse Code. The pupil identifies code and letter on a Morse code chart.

5. The teacher says a word, phrase, or reads a sentence. Student identifies the same word, phrase or sentence in printed form.

6. Have cards with pictures of items and part of corresponding word. Say part of word while showing picture. Ask child to complete the word. For example: under picture of grapes write __apes and let child tell word and missing letters.

7. Place packages of seeds before child. Child then selects in order, the packages whose picture has been named.

8. Describe an object in the room. Pupil must then find it in the room.

9. A coding system can be set up, between colors and tones, increasing in complexity as the child masters each exercise.
   Lowest tone=black; highest tone=white; Colors arranged from light to dark as: yellow-orange-red or yellow-green-blue. Child listens to tones on tape singly and then in sequence. He must designate (colors in boxes, numbers or points to colors on answer sheet) the sequence of the color-tones.

10. A short story is read to child; he is asked to arrange a series of pictures about the story in proper sequence.

11. Read a paragraph; child then selects from three pictures the one which illustrates the story he heard.

12. Teacher taps out a pattern. Child points out that pattern from among many similar ones.

13. Using a buzzer board and pattern cards, the teacher uses the buzzer and the student selects correct pattern visually representing what he heard.

14. One child is chosen "it"; he thinks of an object in room and describes it. Pupils must guess what he has described.

15. Children listen to recording of animal sounds and point to the picture of an animal that makes the particular sound.

16. Developmental Learning Materials: "Auditory-Familiar Sounds" Tape contains fifty familiar sounds; tape is used with fifty flash cards and its purpose is to teach sound skills and identification.

17. Using rhythm band instruments: "Auditory Training" tape provides a pre-recorded series of instruments and patterns. The tape is used along with actual instruments. Each child has two instruments. Pupils play the instrument they hear on the tape.

18. Child can clap hands according to the pattern of a drum beat.

19. Bounce a ball (children can have eyes covered) and have children imitate the rhythm.

Visual-Motor

1. Hopscotch: one child demonstrates a pattern and the others copy it.

2. Observe teacher making a simple paper sculpture and copy it step-by-step.

3. View a pattern of dots or shapes. Locate the same one by touch from among a series of patterns.

4. Show child picture of a shape: example, circle, triangle. Ask him how many different parts of his body he can use to make this shape.

5. Using an Etch-A-Sketch, lay a maze pattern transparency over the screen similar to those on Frostig patterns. The child must coordinate dials to follow through the maze.

6. Child who has difficulty reproducing what he sees may benefit from tactile stimulation, body exercise and temperature change. Letter forms can be reproduced in sandpaper, warm or cooled wet sand or clay. Balance boards having letter shapes can be used for pattern walking.

7. Use Montessori templates, parquetry blocks, bead stringing, button and lacing activities.

8. "Simon Says" and other games involving imitations of someone else's actions may be helpful.

APPENDIX X

Parent Questionnaire: Case History Form (Confidential)

EXPERIMENTAL MODEL SCHOOL PROGRAM FOR CHILDREN
WITH LEARNING DISABILITIES - 1970

CASE HISTORY FORM -- Confidential

Name _____ Interviewer _____

Date of Birth _____ Date of Interview _____

Address _____, Waltham Sex M F

School _____, Waltham Telephone _____

Family: Occupation Education Age

Mother _____

Father _____

Other adults in household _____ Number of rooms _____

Siblings: (all children beginning with oldest)

Name Age Grade Special difficulties

_____

_____

_____

_____

Any unsuccessful pregnancies? _____

Paranatal development: Was there any difficulty experienced with birth?

_____

Was there any difficulty for baby after birth?

Weight _____ Incubation _____ Oxygen _____

Feeding _____ Paralysis _____ Patterns _____

General comments (habits, characteristics) _____

Developmental Milestones:

Talking _____ Walking _____ First words _____

Toilet training _____ Sentences _____

Medical History

	Age	Duration of Temp.	Complications	Hospitalization
Measles				
Mumps				
Allergies				
Chicken Pox				
Infections				
High fevers				
Convulsions				
Surgery				
Other				

Is there any noticeable language problem?_____

Is English the only language spoken at home?_____

How does child use his free time?_____

Has he many friends? _____ A few close friends? _____

Any discipline problems? _____

How are eating habits? _____

What time does child go to bed? _____ Difficulties?_____
(nightmares, bedwetting, insomnia)

Any comments as to coordination; balance; gait _____

Family History: Siblings, mother, father, mother's family, father's family

Laterality _____

Learning Problems _____

History of problem _____

APPENDIX XI

Audio-Visual Supplementation to Treatment

(Phase 2: Individualized Prescriptive Teaching)

Audio-Visual Supplementation to Treatment
(Phase 2: Individualized Prescriptive Teaching)

Auditory

1. Listen and Do, Records and Worksheets, Houghton Mifflin, Boston.
2. First Talking Storybooks, Scott Foresman, New York.
3. Folk Tales and Fairy Tales from Many Lands, Eye Gate.

Visual

Program for the Development of Visual Perception, Marianne Frostig, Follett Publishing Co., Chicago.

Auditory and Visual

Records and Filmstrips

1. Sights and Sounds for the Deaf, Department of Health, Education and Welfare, Office of Education, Washington, D. C.

Filmstrips and Records

1. Our Auto Ride
   Chester, The Pony
   Mr. Bear's House
4. The Mailman of Bayberry Lane
5. Hide Away Puppy
6. Choo, Choo The Little Switch Engine

Society for Visual Education, Inc., Chicago, Illinois 60614

Visual-Motor

1. Inquire - Visual - Motor Development Program, Wyomissing Corporation, Reading, Pennsylvania
2. Instructo-Kinesthetic-Alphabet Cards - Upper Case
3. Instructo-Kinesthetic-Alphabet Cards - Lower Case
4. Instructo-Kinesthetic Numbers

Instructo, Paoli, Pennsylvania

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